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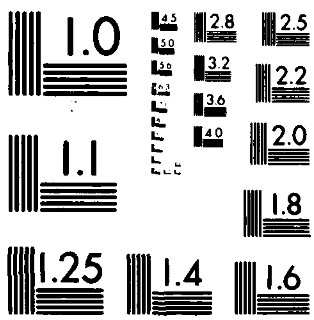

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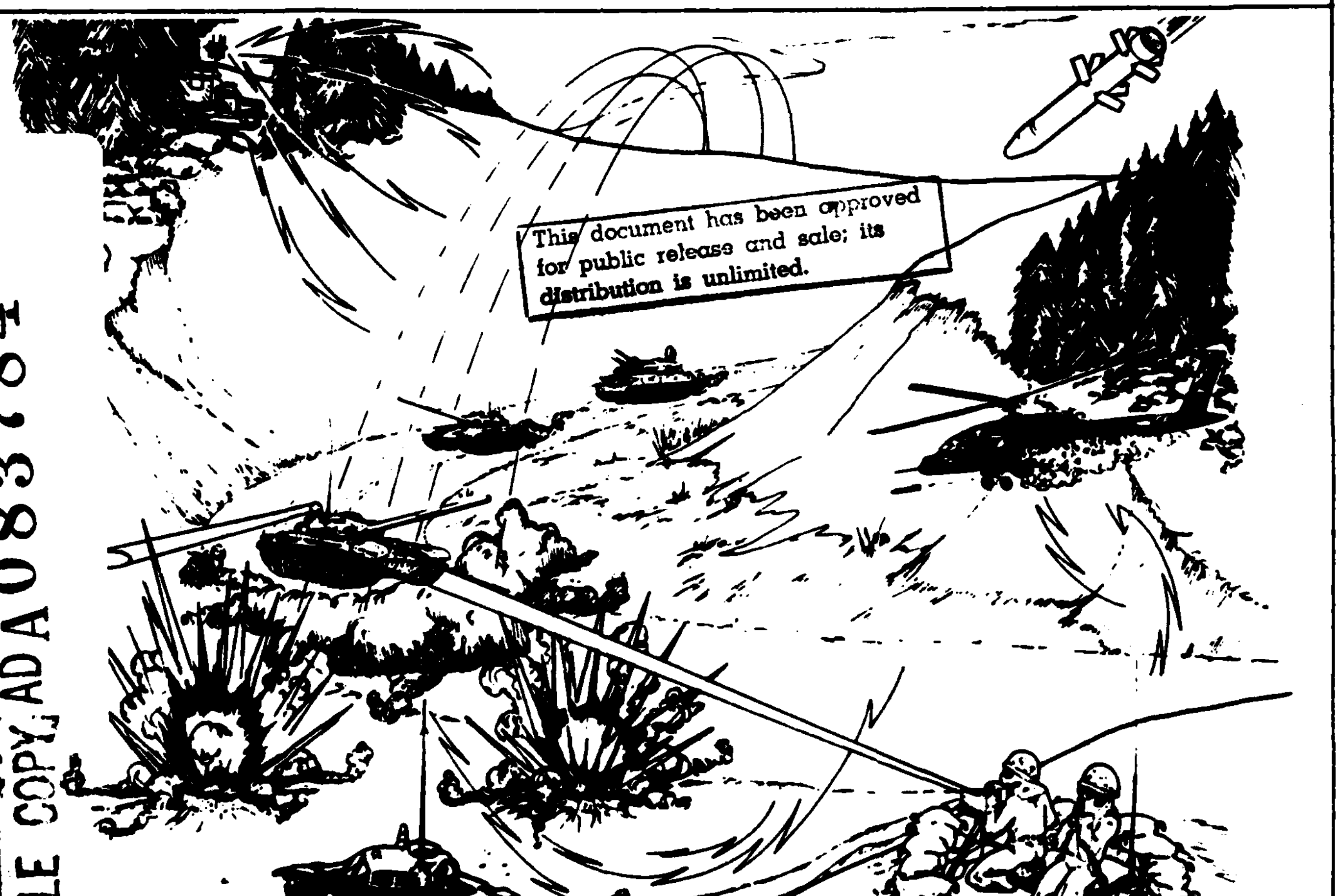
HANDBOOK FOR THE INTEGRATION OF COUNTERMEASURE/ COUNTER-COUNTERMEASURE CONSIDERATIONS INTO THE MATERIEL DEVELOPMENT/ACQUISTION LIFE CYCLE

DEPARTMENT OF THE ARMY
UNITED STATES ARMY MATERIEL DEVELOPMENT AND READINESS COMMAND
UNITED STATES ARMY ELECTRONICS RESEARCH AND DEVELOPMENT COMMAND
COUNTERMEASURES/COUNTER-COUNTERMEASURES DIRECTORATE



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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The basic purpose of this handbook is to provide a roadmap through the US Army material acquisition process, emphasizing the actions necessary to ensure that countermeasure and counter-countermeasure considerations are properly integrated into that process. The methodology by which the CM and CCM aspects of a given concept or system may be examined is developed. The interaction of threat information and system/concept requirements development is discussed, and a method for improving the process is suggested. A matrix correlates the organizations and agencies that

next page

cont.

play a CM/CCM role with the specific events in which those roles are included. Each event-related role is discussed in detail. How product improvement may be used to integrate CCM into an item and the methodology by which this is done is discussed. An example of CM/CCM methodology actually in use is included.

TABLE OF CONTENTS

FOREWORD

This handbook has been prepared under contract DAAG54-78-G-0305, Order D302, by Quest Research Corporation, under the guidance and direction of the DARCOM CM/CCM Office, who, with Quest, provided the substantive writing. Special thanks and appreciation for their contributions are extended to the U.S. Army Intelligence and Security Command, the U.S. Army Operational Test and Evaluation Agency, the U.S. Army Materiel Systems Analysis Activity, the U.S. Army Test and Evaluation Command, the U.S. Army Missile Command, the U.S. Army Aviation Research and Development Command, the TRADOC CM/CCM Office, the U.S. Army Combined Arms Combat Development Activity and the U.S. Army Aviation Center.

Comments on the utilization of this handbook or suggestions for its improvement will be welcomed. Correspondence should be addressed to Commander, U.S. Army Electronics Research and Development Command, Attn: DRDEL-CCM, 2800 Powder Mill Road, Adelphi, MD 20783.

PURPOSE

The basic purpose of this handbook is to provide a roadmap through the U.S. Army materiel acquisition process, emphasizing the actions necessary to ensure that countermeasure and counter-countermeasure considerations are properly integrated into that process. The intended users of the handbook are the individual action officers of the combat and materiel development, threat production, test and evaluation organizations and others involved in the materiel development and acquisition process. The handbook is intended to provide them, in one volume, a compendium of the guidance and directions contained in a myriad of regulations, letters of instruction, pamphlets and other documents. However, it is not intended that this handbook be considered as authoritative or directive in nature; for this purpose the reader should turn to the original documents, which are listed in Appendix D.

SCOPE

Chapter I of the handbook explains why CM/CCM considerations are important. We want to prevent the enemy from seeing us; if he does see us, prevent a hit; if he does hit us, prevent a kill. This "see-hit-kill" phraseology is expanded to include the total threat to the total system, and the terms "countermeasures" and "counter-countermeasures" are defined.

Chapter II describes the materiel acquisition process, with emphasis on CM/CCM aspects. It is realized that many readers may find this material somewhat elementary; it is included here primarily for the benefit of those individuals new to the field, in order that they will be able to understand the context of the remaining portions of the handbook.

Chapter III develops the methodology by which the CM and CCM aspects of a given concept or system may be examined. This chapter should be read by every user of the handbook. The methodology begins as soon as the system concepts are well enough defined for a meaningful analysis to occur and culminates

in the inclusion of CM, CCM and their effects in the Cost and Operational Effectiveness Analysis (COEA) presented to the decision makers for their consideration.

Chapter IV points out that most managers, staff and project engineers involved in the materiel acquisition process will not be experts in the technical aspects of CM and CCM. The process by which they may obtain technical assistance is explained, and reference is made to Appendix C of the handbook, which contains a listing, by technical subject area, of the various sources of expertise, along with addresses and telephone numbers.

Chapter V discusses CM and CCM considerations during the period before the formal initiation of the materiel acquisition process. This period is called the "preconcept phase" and includes Mission Area Analysis. The interaction of threat information and system/concept requirements development is discussed, and a method for improving the process is suggested.

Chapter VI covers CM/CCM-related actions during the materiel acquisition process, beginning with Milestone 0 and continuing through initial operational capability (IOC). A matrix (Figure VI.1) correlates the organizations and agencies that play a CM/CCM role with the specific events in which those roles are included. The text of the chapter then discusses each event-related role in detail. The chapter is organized so that an individual action officer can easily refer not only to his own responsibilities, but also to the roles of all the other players during a given event and his interactions with them. It is also possible for him to look up easily all the actions he will be required to take with respect to a system as it moves through the complete development/acquisition cycle.

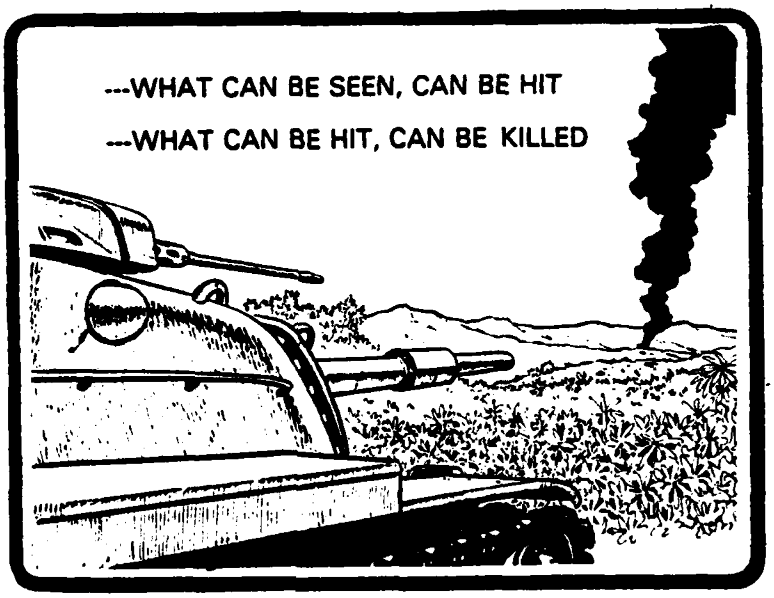
Chapter VII addresses CM and CCM considerations after an item of materiel is fielded, specifically, how product improvement may be used to integrate CCM into an item. The methodology by which this is done is discussed.

The handbook also contains four appendices: a glossary of terms and abbreviations used in the text; a real-life example of CM/CCM methodology actually in use; a list of sources of technical or other assistance; and a list of the references used in completing the handbook and to which the reader is referred for more detail.

The concepts and requirements of this handbook are adjuncts to or expansions of the normal responsibility of combat, materiel, and threat developers to consider the total threat to the total system. This handbook is not a mission and functions statement for the CM/CCM Directorate, US Army ERADCOM.

CHAPTER I
INTRODUCTION

Counter-countermeasures, the protection of the total U.S. system, are important. If the enemy can see us, he can hit us; if he can hit us, he can kill us! Counter-countermeasures are intended to break up this sequence. We want to prevent the enemy from seeing us; if he does see us, prevent a hit; if he does hit us, we want to prevent a catastrophic failure; and we want to recover and continue the mission as quickly as possible. The "see-hit-kill" phraseology of the "How to Fight" manuals is so familiar that it is almost a cliche. We must now expand our concepts of "seeing," "hitting" and "killing" to include the total threat to the total system.



The act of seeing on the modern battlefield is multifaceted. It involves not only the more traditional sensors such as the human eye, radar, sound and flash ranging, but also thermal imaging, low light-level TV, seekers on antiradiation missiles, improved radio direction finders and magnetic signature-activated fuzes in mines. To make sure that the enemy cannot "see" us we must

identify and modify those characteristics of our systems, the signatures, that allow his sensors, operating over the entire electromagnetic spectrum, to see us.

Our concept of a "hit" must also be expanded beyond the simple ballistic encounter. The enemy has or will have systems that jam our communications links, confuse our precision-guided munitions, home on our infrared signature or radar image and obscure our own sensors. We must concern ourselves with enemy systems and techniques that can interfere with or degrade the performance of our total systems which includes weapons, combat support, C^3 and combat service support systems, as well as the personnel required to operate them.

We define "killing" to cover the whole spectrum of effects that the enemy's systems have on our own. This ranges through simple confusion of communications, the requirement to repeat messages, decoying a precision-guided missile, breaking a command link, blinding a night-vision device, burning out electronic circuits with electromagnetic pulse, and high-energy laser destruction of optical systems.

On the battlefield of the future, the commander is going to need all the "force multipliers" the Army is currently developing because he will probably be outgunned and outnumbered. We expect superior training and equipment to even or better the odds. The SOTAS, RPV and other sophisticated sensor systems will allow us to "see" the battlefield while Copperhead, STARTLE, AAH and other advanced weapon systems will provide a degree of precision to the battlefield that was never before achievable. Systems such as SINCGARS, TOS and TACFIRE will allow increased control over far-flung, fast-moving and hard-hitting forces. The degree of detailed knowledge and control given the commander and the precision of the weapons will allow us to practice mass maneuver and economy of force in a manner that will tip the scales in our favor both operationally and logistically.

Our modern and future forces on the battlefield represent a highly complex "system," all parts of which have to work for the whole to be able to function. We must have a healthy respect for the enemy's countermeasures in developing our technical force multipliers. For example, just as we are developing devices that can see through conventional smoke, there could be improved smokes under development that might block our most sophisticated sensors. We cannot allow the enemy to seriously interfere, through his countermeasures, with our

weapons delivery, crew protection, intelligence gathering, and command, control and communications systems. In order for the commander to have these systems at his fingertips, responsive and effective, accomplishing their intended mission, they must be developed and fielded in such a manner as to eliminate or reduce to a minimum susceptibilities that could result in system degradation.

Countermeasures and Counter-countermeasures Defined

It is recognized that general definitions exist for countermeasures, electronic countermeasures, and electronic counter-countermeasures in AR 310-25. More specific definitions for electronic countermeasures and electronic counter-countermeasures are contained in AR 105-2. To focus emphasis on the specific orientation to be covered by this handbook, these terms are defined as follows:

- Countermeasures (CM) are enemy devices, techniques and/or actions which have as their objective the reduction of operational effectiveness or the exploitation of friendly equipment.
- Counter-countermeasures (CCM) are friendly devices, techniques and/or actions taken to ensure the operational effectiveness of and/or deny enemy exploitation of friendly equipment despite countermeasure activity by the enemy.

It is important to realize that "the threat" is composed of two parts. The first is, broadly speaking, the enemy systems against which friendly weapons are targeted. The second part comprises those enemy systems which are targeted against us. It can be seen that countermeasures, as defined above, constitute this second part of the threat. It should also be noted that CM and CCM can be tactical as well as technical, but we must remember that the need to apply tactical CCM could limit operational flexibility. Consideration of both tactical and technical CCM early in the acquisition process should provide for the best CCM capability.

Determining possible CM and applying technical CCM properly require the joint actions of the three communities that are primarily involved in the materiel acquisition process: intelligence, the combat developers and the materiel developers. They also require that CCM be considered in a systematic fashion. These two aspects, the materiel acquisition process and a systematic approach to CM/CCM, are addresssed in the next two chapters.

CHAPTER II

COUNTERMEASURES AND COUNTER-COUNTERMEASURES IN THE MATERIEL ACQUSITION PROCESS

In this chapter we will describe the CM/CCM contributors and activities in the materiel acquisition process. We will define the players and their responsibilities in general terms. The intent is to put these activities in a CM/CCM perspective, not to rehash the materiel acquisition process, as this is amply covered in other DA and MACOM publications.

The timely application of CCM to developmental systems is important if we wish to achieve maximum tactical and cost effectiveness. This is dependent on three factors:

- Complete threat information, in technical as well as tactical detail, must be requested and provided in advance of the need.
- The technology base for CCM must be available to support the materiel development milestones.
- There must be a thorough and continuing understanding and interaction between the combat and materiel developers and the intelligence community throughout the materiel acquisition process.

Failure to apply CCM in a timely fashion may result in:

- Delay in the fielding of a system.
- CCM of higher cost due to delays and retrofits.
- Less effective operational systems while waiting for CCM fixes to become available.

Players and Responsibilities

The players in the materiel acquisition process can be roughly broken down into three basic groups: materiel developers, combat developers and the intelligence community. The materiel developers include the DARCOM R&D commands and laboratories which develop the technology base and the materiel systems. The combat developers include the Headquarters, centers and schools of TRADOC which define the requirements, develop the tactical concepts and act as the user's representatives. The testing community, including TECOM, TCATA and OTEA, is usually divided between and included in the materiel and combat development groups. The intelligence community consists of INSCOM, the intelligence activities of DARCOM and TRADOC, and the national intelligence agencies.

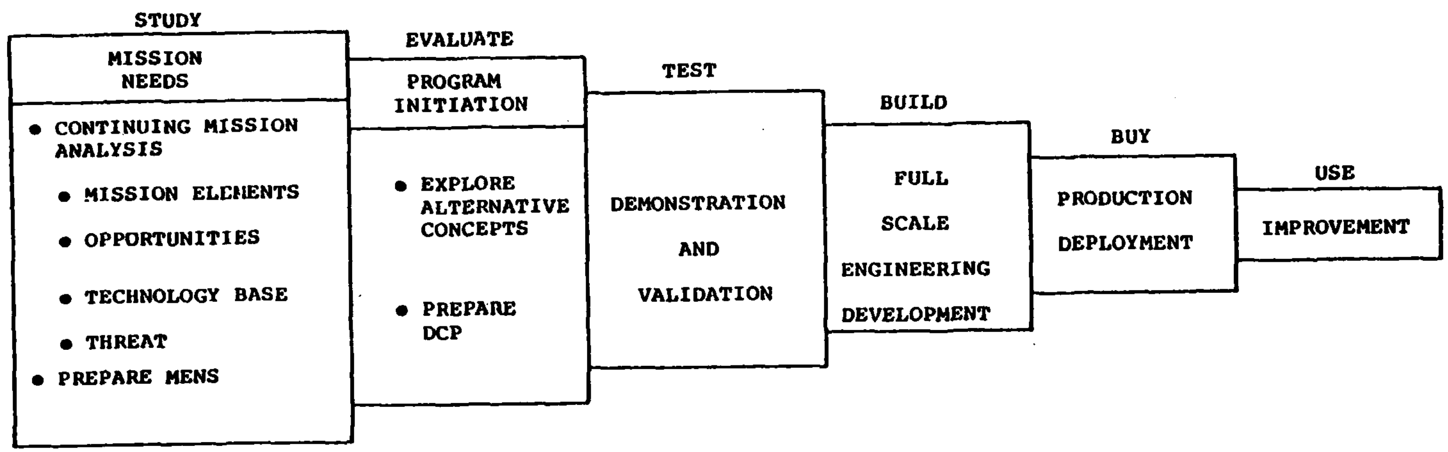
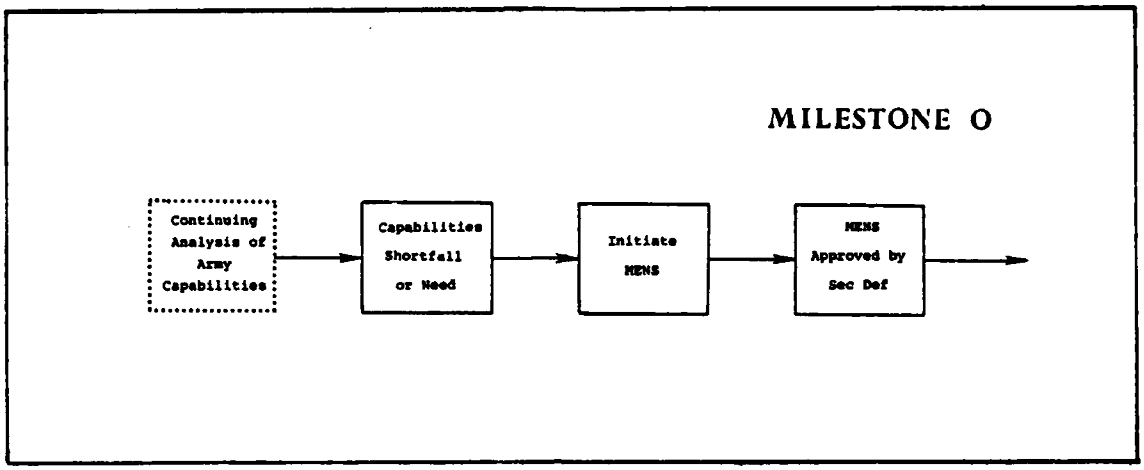


Figure II.1 MATERIEL ACQUISITION PROCESS

The Materiel Acquisition Process

The process by which materiel systems or items are brought into the Army inventory consists of six major phases, as shown in Figure II.1. The process by which CM and CCM considerations are integrated into the materiel development and acquisition life cycle is described below and summarized in Figure II.2.

Continuing Analysis of Mission Areas



This phase, which might also be called the "preconcepts phase," is oriented on the study of mission needs. This study will probably be conducted as a formal Mission Area Analysis. Much of this analysis will be driven by CM/CCM considerations, that is, by increases in the vulnerability of current systems. The phase grows out of the continuing analysis of Army capabilities, which reveals one or more capability shortfalls or needs. Based on these needs, a Mission Element Need Statement (MENS) may be initiated and submitted for approval by the Secretary of Defense. For non-major systems, a Letter of Agreement may be initiated.

The phase should be characterized by joint efforts, as the combat developers explore new operational concepts, the materiel developers expand and exploit the technology base, and the intelligence community analyzes the threat; all three major participants should maintain a continuous dialogue with each other regarding the threat, technological developments and force needs.

The combat developers will analyze new concepts for tactical CCM, identify current vulnerabilities for solution in future systems and identify

	STUDY	EVALUATE	TEST	BUILD	BUY	USE
	CONTINUING ANALYSIS OF MISSION AREAS	EXPLORATION OF ALTERNATIVE SYSTEM CONCEPTS	DEMONSTRATION AND VALIDATION	FULL-SCALE ENGINEERING DEVELOPMENT	PRODUCTION AND DEPLOYMENT	OPERATIONS AND PRODUCT IMPROVEMENT
COMBAT DEVELOPER TRADOC	• Analyze new concepts • Identify vulnerabilities • STOG	• Develop general operational CCM characteristics • Analyze/compare alternatives	• Identify signatures • Test vulnerabilities • Determine minimum essential CCM	• Update vulnerabilities • Complete solutions • Test in total CM environment • Make tradeoffs	• Identify future needs • Make final changes	• Identify new/changed vulnerabilities
MATERIEL DEVELOPER DARCOM	• Expand technology base • Determine gaps in technical capabilities	• Develop general technical CCM characteristics • Modeling/simulation • Reduce signatures	• Identify susceptibilities • Develop solutions • Test CCM	• Update susceptibilities • Apply CCM • Test solutions	• Apply CCM solutions to production models • Review technological advances	• Improve CCM
THREAT DEVELOPER INSCOM	• Define threat CM • Project threat • Investigate new directions	• Develop threat: - to concepts - system specific - reactive	• Identify specific enemy capabilities/threat	• Update threat	• Continue threat evaluation • Investigate new directions	• Identify changes in enemy capabilities

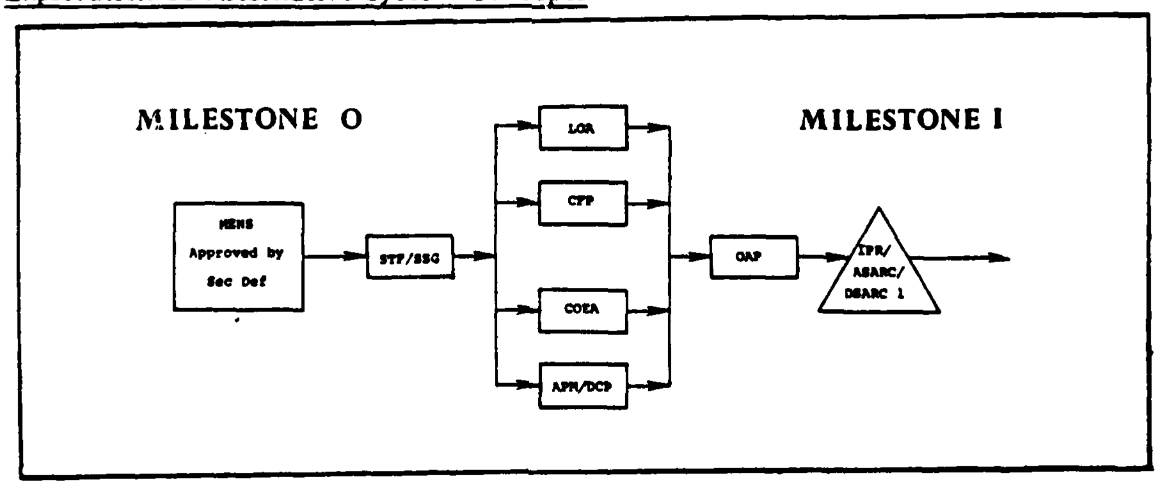
Figure II.2 CM/CCM CONSIDERATIONS IN THE MATERIEL ACQUISITION PROCESS

vulnerabilities that may be amenable to technical solution. The combat developers inform the materiel development community of their needs through the Science and Technology Objectives Guide (STOG) and other forums. They must also keep the intelligence community aware of new concepts, techniques and directions and request the general threat information that will support future phases of the materiel acquisition process. The combat development product of this phase may be a MENS which, upon approval by the SECDEF at Milestone 0, results in program initiation.

The materiel developers will, in this phase, continue their expansion of the CCM technology base as a result of state-of-the-art advances, better understanding of threat CM technology and the stated needs of the combat developers. The enemy's capability arena will be constantly surveyed to determine gaps in the CCM technology and enemy capabilities to exploit these gaps. New technology capabilities are broadcast to the combat developers and intelligence community through the SPIDERCHARTS, other documents, and dialogue to orient their conceptualizations and information gathering/intelligence production efforts. The materiel developers will keep the intelligence community informed of new signature information and new counter-countermeasure technology concepts and will request specific threat countermeasure information to support technical investigations.

The intelligence community attempts to define threat countermeasures, in complete technical and tactical detail, to which our equipment may be vulnerable. Based on their knowledge and past experience they project the general threat countermeasures through the time frame of the identified capability needs. They inform the combat and materiel developers of new enemy capabilities and investigate new enemy countermeasure directions suggested in the dialogue with the combat and materiel developers.

Exploration Of Alternative System Concepts



During this phase, a formal development program is initiated in which alternative system concepts are explored and the best possible solution identified. Enemy countermeasures that may limit the application of a concept and the counter-countermeasures that can be applied are major considerations. The phase begins at Milestone 0, at which point a Special Task Force or Special Study Group (STF/SSG) may be formed to direct the effort. Their major responsibilities include the preparation of several documents: a Letter of Agreement (LOA), a Concept Formulation Package (CFP) in which the Cost and Operational Effectiveness Analysis (COEA) is a major part, and a decision paper (Army Program Memorandum or Decision Coordinating Paper) for review at Milestone I. An Outline Acquisition Plan (OAP) is also prepared in preparation for that review. The phase ends at Milestone I, the decision to proceed with demonstration and validation; the review body may be on In Process Review, an Army System Acquisition Review Council, and/or a Defense System Acquisition Review Council (IPR/ASARC/DSARC).

The combat developer will develop the general operational CCM characteristics of the alternative materiel and tactical concepts and identify potential vulnerabilities for technical solution. Technical CCM solutions will be compared against tactical solutions. Using the CM/CCM analysis methodology described in Chapter III, susceptibilities/vulnerabilities will be determined as well as possible solutions. Alternative concepts may be compared through simulation. A cost and operational effectiveness analysis, with participation by the materiel developers and threat representatives, will assist in reaching the proper conclusions concerning the conceptual system vulnerabilities and give appropriate direction to the CCM development efforts. The intelligence community will be informed of new tactical concepts and techniques and more detailed threat information will be requested.

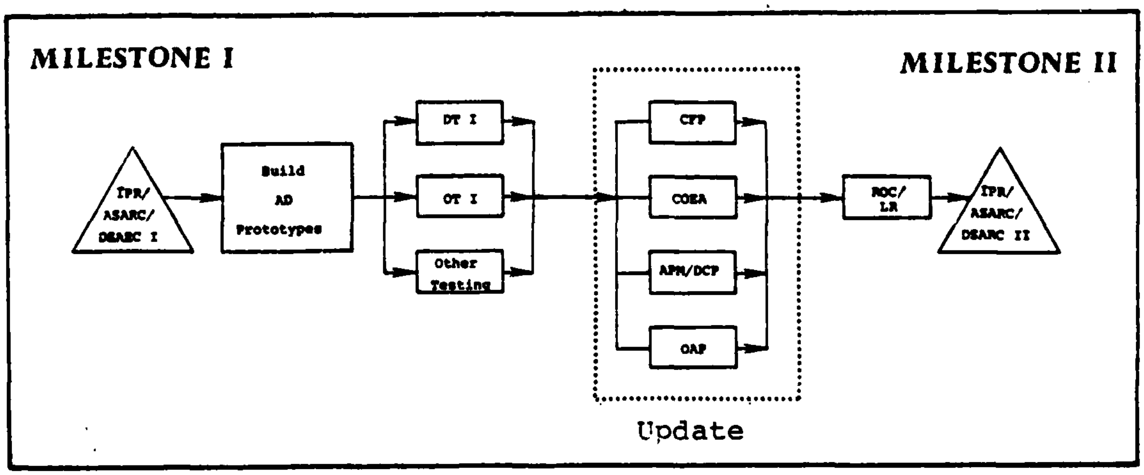
The materiel developer will develop the general technical characteristics, signatures and CCM for the new materiel concepts. These new materiel concepts must then be evaluated in a realistic countermeasures environment. One-on-one modeling and simulation efforts will feed susceptibilities to force-on-force studies. The intelligence community must be informed of the technical characteristics of the evolving materiel system concept alternatives and

specific technical threat countermeasure information must be requested. There will be emphasis at this time on approaches to signature reduction and/or alteration and identification of relative vulnerabilities of the alternatives. The technological aspects of the identified CM and CCM will be updated, especially as regards generic signatures and CCM techniques.

The intelligence community will develop the threat to the evolving tactical and materiel concepts, including a System Threat Assessment Report (STAR) and rank ordered enemy responses, or "reactive threats," to our emerging systems. They provide specific threat documents to the combat and materiel developers. They provide and support detailed information for games, tests and evaluations, e.g., COEAs. They continue to investigate new directions suggested by the combat and materiel developers.

Three documents of particular importance with respect to CM/CCM are the LOA, the COEA, and the OAP. The LOA will include a brief discussion of the threat to and vulnerabilities of the system. This is the requirements document that supports entry into the demonstration and validation phase at the Milestone I decision. The COEA will be the vehicle for presenting the results of the CM/CCM analysis process to the decision bodies. The Threat Support Plan contained within the OAP will detail, for the intelligence community, milestones for the identification of the threat countermeasure input required and for the provision of the threat. The program reviews supporting the Milestone I decision will look very closely at how the threat was treated.

Demonstration and Validation



During this phase advanced development prototypes will be built and tested. The preliminary design and engineering of the competing materiel concepts will be verified. The degrees of vulnerability accepted and protection (CCM) required will be expressed in bands of performance. This phase will also include the first formal testing that will be performed on the prototype models (development test (DT) I, operational test (OT) I and other testing that may be done), as well as updates to the documents which were prepared earlier. In preparation for Milestone II, a more detailed requirements document will be prepared.

The combat developer will identify, through wargaming and simulation, the operational signatures of the prototypes in their tactical employment. Vulnerabilities will be identified based on system design, hardware analysis and testing. During the operational test and evaluation, vulnerability in a realistic countermeasures environment will be assessed to determine the operational feasibility of the proposed counter-countermeasures. The combat developer must define the minimum essential CCM characteristics of the system. He must keep the intelligence community updated on the specific operational characteristics of the system, especially signatures and vulnerability aspects, and request any specific threat information required.

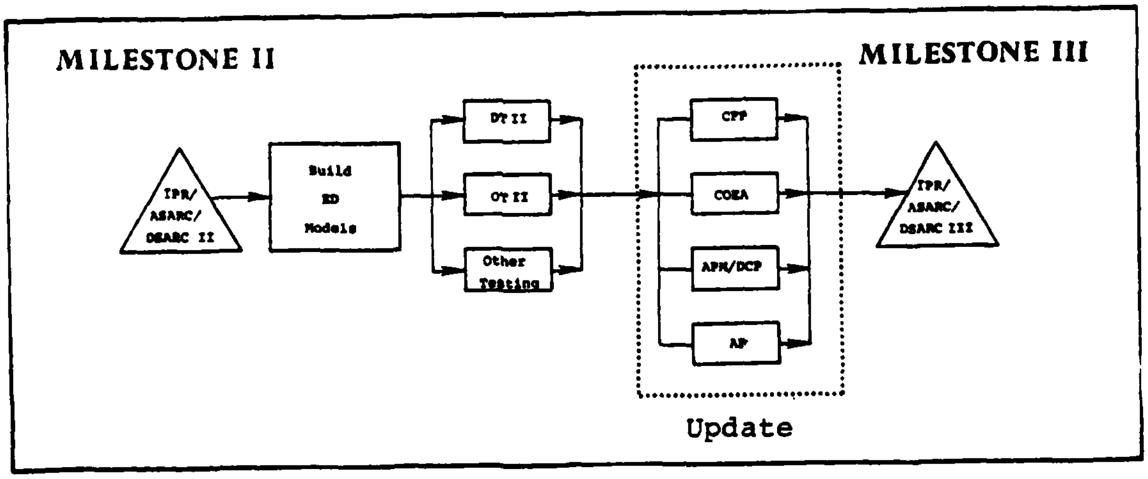
The materiel developer must identify the technical signatures and susceptibilities of the materiel systems. He must develop solutions to technical vulnerabilities. Development test and evaluation in a realistic countermeasures environment will demonstrate the technical feasibility of candidate CCM. Non-CCM related design changes must be reviewed for signature and susceptibility impact. The Outline Acquisition Plan is expanded and becomes the Acquisition Plan (AP). The intelligence community is updated on the technical characteristics of the materiel system, especially signatures and susceptibility aspects, or Critical Intelligence Parameters, and is also tasked, based on the now more detailed Acquisition Plan, to provide updated countermeasure information. The AP also identifies the system's survivability and vulnerability criteria. The Program/Project/Product Manager should have been appointed at the beginning of this phase and should now be fully active in the CM/CCM coordination efforts.

The intelligence community, based on general guidance and specific tasking by the combat and materiel developers, generates the specific threat to the identified characteristics of the materiel system prototypes and operational concepts. Enemy capabilities to exploit specific signatures and susceptibilities are identified and reactive threats to the system are postulated. The intelligence community provides the combat and materiel developers with updated threat information and investigates the possibility of new enemy countermeasures suggested by the developer's inputs.

This phase ends with joint action by the combat and materiel developers to prepare a Required Operational Capability (ROC) document or Letter Requirement (LR) to support entrance into full-scale engineering development at Milestone II. These requirements documents should address the updated threat to the system and its essential CCM characteristics. The program reviews supporting this milestone will look specifically at the updating, validating and use of the threat.

Full-Scale Engineering Development

During this phase the design of the materiel system becomes fixed; it is a close approximation of the final product; however, engineering trade-offs may still be made. Engineering development (ED) models of the system are built and their military worth is fully demonstrated through testing. Once again the decision documents are updated.



The combat developer will update the list of operational signatures and vulnerabilities after evaluating the solutions developed and applied to the designs. He must identify technical or operational solutions to any vulnerabilities that remain. The military utility, operational effectiveness and suitability of the system must be tested and evaluated (OT II) in as realistic a total countermeasures environment as possible. The final trade-offs will be made and the final design selected by the end of this phase. The intelligence community must be updated on the operational characteristics of the system.

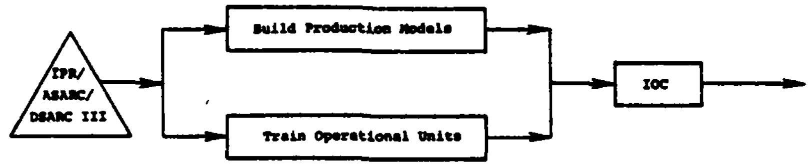
The materiel developer will update the list of technical signatures and susceptibilities of the systems after evaluating the trade-off options. Final technical counter-countermeasures are applied or planned for the next phase. The developmental test (DT II) will use engineering/scientific testing methods to provide detailed data on signatures and susceptibilities for precise evaluation. The tests will demonstrate whether the signature and vulnerability reductions are complete and whether acceptable solutions are in hand. The specific information on system technical characteristics is fed to the intelligence community for their use in investigating threat capabilities. Non-CCM design changes must be checked to ensure that there is no adverse impact on system signatures or susceptibilities.

The intelligence community will update the threat to specific characterisitics of the materiel system, the threat to the operational concept and the reactive threat. The combat and materiel developers are kept informed of changes in the threat, and threat capabilities are investigated based on the now specific and detailed information provided by the developers.

The program reviews that support the production and deployment decision, Milestone III, should include a formal vulnerability analysis to confirm the desirability of making the transition to production. Programs should not be permitted to enter production on the contention that significant deficiencies can be corrected during production, unless that contention can be verified by appropriate testing.

Production and Deployment

MILESTONE III



During this phase, the equipment is produced and distributed, operational units are trained, and final approved solutions to system deficiencies are applied.

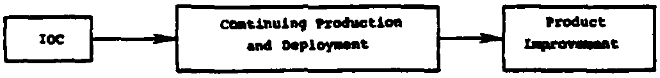
The combat developers identify improved CCM capability needs for future application. They make any final operational concept changes necessitated by the CCM options selected and the vulnerabilities remaining. They review the operational characteristics of the system based on new knowledge and newly identified enemy countermeasurecapabilites. The combat developers keep the materiel developers and intelligence community abreast of changes in operational doctrine and of their needs for CCM technology and enemy CM information throughout this phase.

The materiel developers will apply the approved CCM solutions to the production models of the equipment. They will continually review the system characteristics based on technological advances and new knowledge of enemy capabilities to exploit signatures and susceptibilities. The materiel developers must review non-CCM changes in the system design for signature and vulnerability impact. They continually update the combat developers and the intelligence community on new technical CCM capabilities.

The intelligence community continues to evaluate threat capabilities to counter the system. They investigate new countermeasure directions suggested by the combat and materiel developers as enemy CM technologies mature.

The end of this phase has traditionally been the date of initial operational capability (IOC), that is, the first attainment of the capability by a Modified Table of Organization and Equipment (MTOE) troop unit to employ the new system or item effectively.

Operations and Product Improvement



This phase, which begins at IOC, is normally included in the production and deployment phase, but is split out here in recognition of the change in mind set that occurs after IOC. Improvements to the system are made in response to user requirements and changes in the threat environment.

The combat developers must continue to consider enemy countermeasures, especially changed or new enemy capabilities, when operational doctrine changes. As they see new technology introducing opportunities for the enhancement of the system or for vulnerability reduction they must make their needs known. New vulnerabilities resulting from changes to the system or increased enemy capabilities must be identified and corrected. The intelligence community must be informed of changes in operational doctrine or concepts.

The materiel developers continue to work on improved CCM capability needs that have been identified by the combat developers or suggested by state-of-the-art technology advances. They review and update the signatures and susceptibilities of the system based on new CCM-related technology and postulated or confirmed enemy capabilities. They ensure that changes in signatures and vulnerabilities caused by other system changes are recognized and accounted for.

The intelligence community must keep operational systems in mind and ensure that the combat and materiel developers are notified when there is a change in enemy capabilities to exploit the system signatures or vulnerabilities.

CHAPTER III

ANALYZING COUNTERMEASURES AND COUNTER-COUNTERMEASURES

A major purpose of this handbook is to lay out a methodology by which the countermeasure and counter-countermeasure aspects of a given concept or system may be explored, defined, developed and evaluated. The purpose of this is to select a system which has a minimum of weak areas and to evaluate alternatives to reduce its vulnerability to enemy countermeasures through technical and/or tactical means in order to ensure the system will perform on the battlefield to its required capability.

In the past, this process all too frequently has been only partially done or left undone until late in the development cycle. At that point there are normally two alternatives, neither of them pleasant: to delay system development and deployment until the problems are corrected or to deploy a system that is easily counterable on the battlefield. The costs associated with both of these alternatives are high. On the one hand are the high dollar costs of making potentially major changes to a system late in the development cycle; on the other hand are the even greater costs associated with defeat or degraded performance on tomorrow's battlefield. It is obviously much better to identify potential problems early in the development cycle, when they can be corrected simply and cheaply, without delaying system development. A CM/CCM analysis should thus be performed as soon as a conceptual system begins to have concrete form and shape; if possible, it should be done as early as the mission area analysis. Weak links identified by this analysis may be corrected by technical or tactical CCM or combinations of both. In any event, potential technical and tactical solutions must be assessed together in the context of the threat to determine their contributions to increased mission effectiveness and reduced system vulnerability.

A note of caution is in order here. Just because a CM/CCM analysis is accomplished early on does not mean that the process is completed. The first analysis will necessarily be approximate, for a variety of reasons. Our knowledge of the threat will certainly improve over time, particularly our estimates of how the enemy will react to the presence on the battlefield of the system we are developing (reactive threat). Also our knowledge of the capabilities and limitations

of our system will move from the general to the specific as various design alternatives are considered and accepted or rejected. For these reasons our estimate of the CM/CCM situation must be updated. The best way to do this is to perform a CM/CCM analysis as part of the cost and operational effectiveness analysis (COEA) which precedes every milestone review. Current capability requires this be conducted as an off-line analysis and subsequently incorporated into the COEA. The analysis must then be updated whenever there are major changes to the system or to the threat facing it. In fact, CM/CCM analyses may and probably will be required after IOC.

Who is responsible for performing this analysis? Just as the combat developers, the materiel developers and the threat community are jointly responsible for transforming a mission need into an operational system, so are they responsible for ensuring that it will operate in the countermeasure environment found on the battlefield. The individuals who actually sit down and analyze the CM/CCM situation will be the same ones (at least initially) who are managing all the other aspects of the system at the time, i.e., members of a joint working group, special task force, special study group, the PM and TSM staffs, contractors or representatives of the respective combat development, materiel development and intelligence communities.

In addition to the combat, materiel and threat developers, there are others who will find the CM/CCM analysis process described in this chapter to be of great utility in their roles in the development of new materiel capabilities. The development and operational testing community, during meetings of TIWGs or other working groups, will find the analysis process helpful to them for defining realistic and necessary test requirements to assure that the developmental system's effectiveness on the battlefield will be adequately evaluated. Representatives of private contractors and their governmental interfaces may also use the process in defining and meeting the CM/CCM requirements of proposed materiel items and systems.

General Guidelines

When analyzing CM/CCM one must consider the total threat to the total system. In the past, enemy countermeasures were normally considered in two areas only. One was the ballistic threat, and much research effort has been expended on improving the ballistic hardening of our systems. On the other hand,

TOTAL THREAT TO TOTAL SYSTEMS

- SENSORS
- ELECTROMAGNETIC D/F
- JAMMING
- SMOKE
- NUCLEAR
- CHEMICAL/BIOLOGICAL
- BALLISTIC
- TACTICS
- DOCTRINE
- SYSTEM SECURITY

the term countermeasures has, to many people, been restricted and applied only to electronic countermeasures, or ECM. However, ballistics and ECM are only two parts of the total threat. We must also consider the implications of such things as enemy tactics and doctrine (tactical CM), enemy target surveillance and acquisition devices, and the use of smoke, obscurants, chemical or biological agents, and nuclear weapons, with all their effects on a realistic battlefield. By total system we mean that all elements which are associated or interact with the functioning of our system, plus systems which support or may be colocated with our system, must all be considered. For instance, it does little good to provide visual camouflage for a division command post and its vehicular traffic if the RF, IR and acoustic signatures of all the associated communications and power generating equipment are ignored. Also, despite the increasing automation of modern military materiel, it must never be forgotten that the soldiers who operate the equipment are an indispensable part of the total system. A CB attack against the crew can put a tank out of action just as surely as an antitank guided missile.

An adequate CM/CCM analysis cannot be conducted by one or two people in a casual bull session. Rather, the collective knowledge and experience of technical, tactical and threat experts will all be needed. Therefore, the groups involved in the process should include representatives from the combat development, materiel development, and threat analysis communities and should normally be chaired by a user representative, i.e., a member of the combat development community; the system user will be the ultimate loser if the process is not accomplished correctly. The specific participants in a CM/CCM analysis will depend upon the system's technical characteristics and capabilities, its methods of employment on the battlefield and the current and projected threat anticipated against it.

An important point to keep in mind when directing this process is to develop the subject in a systematic manner. Otherwise, the product is likely to skip from topic to topic, never thoroughly examining any area and skipping lightly over many. A second point in this regard is to ensure that accurate records are kept. At a future decision point it will be important to know why a given CM or CCM was not considered important enough for inclusion in the analysis, as well as the background of those that were. A third point is that one of the purposes of the CM/CCM review is to determine which potential countermeasures require detailed technical and tactical analysis by experts in order to propose appropriate counter-countermeasures. That is, the nature of the threat and its impact on the system, both technically and tactically, must be clearly understood and used as a basis for the subsequent technical analyses.

All participants in the process should realize that counter-countermeasures, while important, are only one contributor to the combat effectiveness of the system under development. Many other factors also contribute to that combat effectiveness, and some of these will be more important than some CCM. For instance, due to weight constraints, combat aircraft must often make trade-offs between carrying CCM equipment and mission stores. All must also realize that there is no such thing as a totally invulnerable system. Risks will always be inherent in even the most nearly perfect system. In addition, the search for perfection would inevitably lead to prohibitive costs for our already expensive systems. Finally, at some point in the process of developing a new system, the design must be frozen; otherwise it will never enter operational service. At that point the system design should be sufficiently adaptable so that it

can accommodate new CCM as required by the appearance of new hostile CM. For every developmental system, there are decision makers who have the responsibility for making these trade-off determinations. It is the responsibility of the CM/CCM analysts to develop and provide advice and recommendations for the decision maker as to the impact of omitting certain CCM and the relative worth of various CCM options. Stated another way, the purpose of a CM/CCM analysis is to find weak links in the total system and to identify technical and tactical fixes in terms of cost and effectiveness so that decision makers can determine where to spend money in the most profitable way.

It must also be kept in mind that most real systems differ in some degree from the idealized model that is presented in Army regulations. This handbook, like those regulations, is offered as a guide; the generalized analysis method presented here must be modified and adapted to the particular circumstances of the system under investigation.

ANALYSIS METHODOLOGY

The general methodology for analyzing countermeasures and defining and developing appropriate counter-countermeasures is summarized in Figure III. 1. This analysis process should be initiated as soon as system concepts are well enough defined for a meaningful analysis to occur, e.g., during mission area analysis. It should then be updated periodically as our knowledge of the system, the threat and their interactions becomes more detailed.

Responsibility for the overall process resides within the user community (TRADOC). The specific TRADOC activity/staff element responsible for the analysis will change according to the developmental state of the system. For example, during MAA the combat development staff of a proponent school/center will have the lead; shortly after Milestone 0 (approval for a new system start), a joint working group/special task force will be responsible; once a TSM is appointed, he will have responsibility for subsequent CM/CCM analyses. At each stage of the process, the combat developers will be assisted by representatives of the materiel development and intelligence communities, and certain specific steps of the process will be conducted by them.

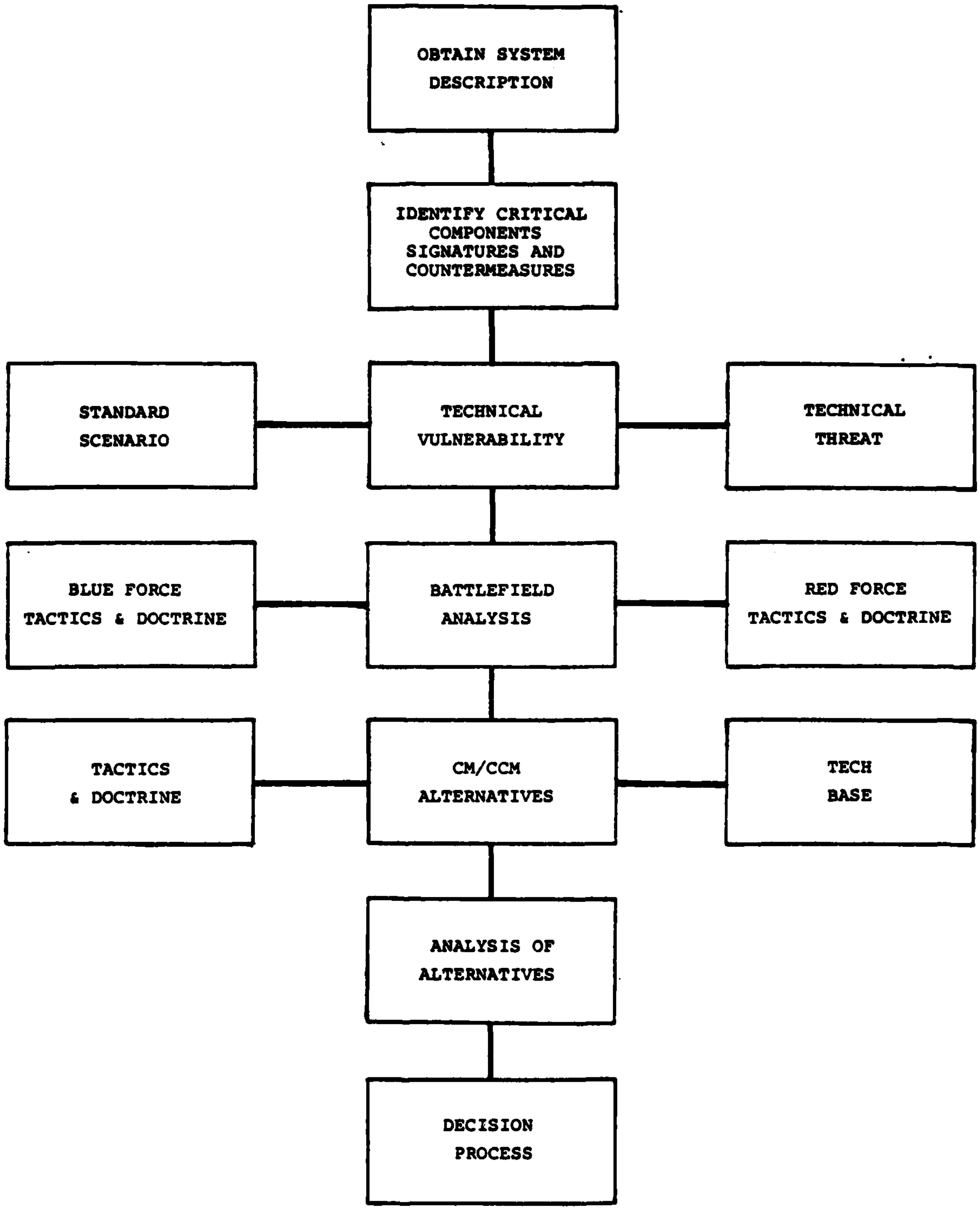


Figure III.1 CM/CCM ANALYSIS METHODOLOGY

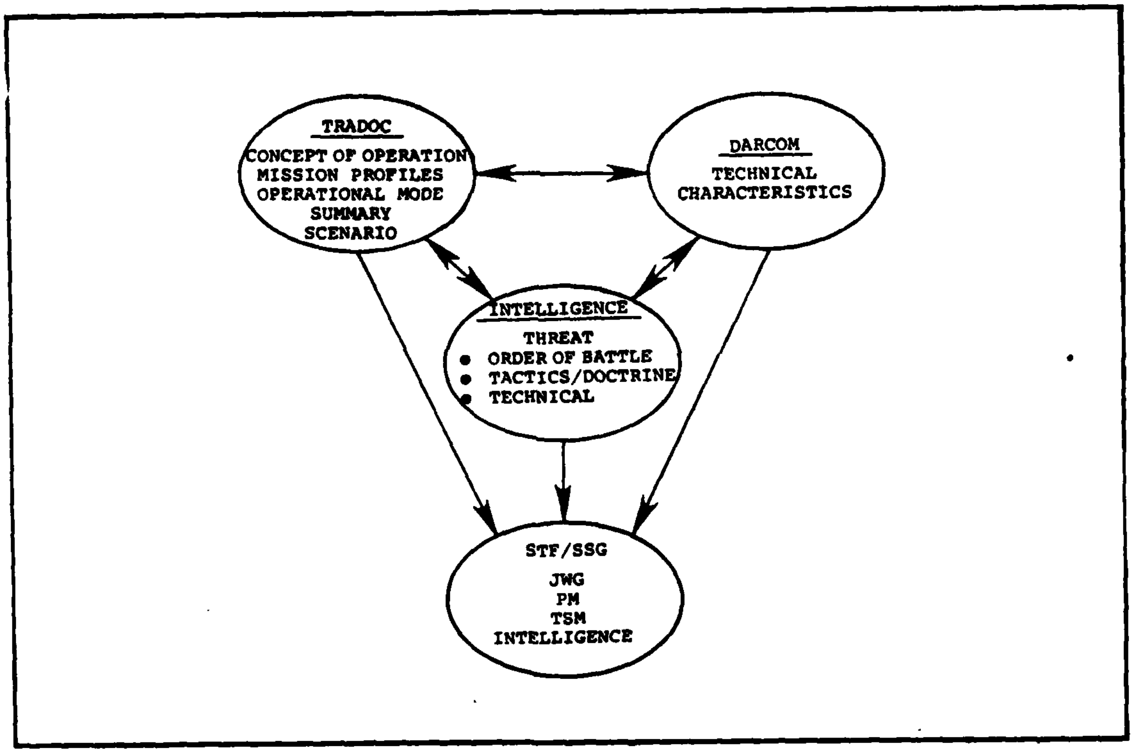
The first step—system description—will be led by TRADOC. It entails the generation of the first, essential inputs to the process and the identification of key participants in the process. In the second step, also led by TRADOC, the technical and tactical functions of the system will be defined as well as the nature of the current and projected threat against those functions. The next phase will be performed by the DARCOM technical assessors on the basis of information provided by the analytical group. In that phase the technical vulnerability of the total system to each postulated threat (CM) will be calculated individually. Also during this step technical CCM must be nominated, evaluated and carried forward. The results of these calculations and evaluations, in the form of hard data or ranges of data, e.g., P_k, distances, S/N ratios, reduced system performance as a result of threat impact in a one-on-one encounter, will be included in the item level system performance estimates and be used during the next step. TRADOC has the lead for the battlefield analysis and subsequent steps of the process. During the battlefield analysis a force-on-force wargame will be conducted to determine the impact of reduced system performance on total force performance and, if required, the most successful counter-countermeasures (technical and tactical) for the system. For each likely potential threat to the system a list of technical, tactical or combined solutions will be produced, along with the cost and relative effectiveness of each. The next step, entitled "Decision Process," is, in fact, the introduction of the various alternative solutions, with the cost and effectiveness of each, into the formal COEA process. The off-line assessment is incorporated into the COEA and presented as an aid to the decision making process for the determination of desirable, affordable, effective CCM to be integrated into the conceptual/developmental system.

Obtain System Description

By this we mean obtaining a complete description of the total system. This effort should be led by the combat developer and should include input from all three major communities involved: the materiel developers should contribute the system's technical characteristics; the combat developers will provide its concept of operation, likely mission profiles/operational mode summary, and the scenario in which it will operate; and the intelligence community will be responsible for developing and producing the known and projected threat, including order of battle information, technical capabilities, and enemy tactics and doctrine.

The key to this step is understanding the system's functions on the battlefield and the nature of the threat facing it. All this information will be provided to the analysis group.

During this phase of the analytical process, it is also very important to begin the identification of other key participants for subsequent contributions to the analysis. This can be done readily by reviewing the key components and technologies involved in the system, its employment on the battlefield and then referring to Appendix C of this handbook.



Identify Critical Components, Signatures and Countermeasures

The next step, that of identifying the system's critical components and signatures and the potential countermeasures against them, should also be led by the combat developer. A useful method of breaking a system down into its components is to use the group's military judgment and experience to determine all of the functions of a system and the links or stages of the system which perform those functions. The group should then separate the functional components of the system that are significantly different in terms of their physical locations, signatures/detectabilities or susceptibilities. As an example, the analysis group for the Copperhead laser-guided projectile system used seven components during their analysis:

- The ground laser designator,
- A remotely piloted vehicle, including its designator and data links,
- The battalion fire direction center,
- The battery fire direction center,
- The firing battery (or battalion),
- The communications linking the other components together, and finally
- The round; including its sensor and guidance subsystems.

As can be seen, a "component" for our purposes may be small and compact (the round) or diffuse and insubstantial (the communications links) or large and complex (the firing battery, which includes the guns, the vehicles to move them and the men to operate them).

As the group is developing the organization of the system into its critical components, it will also be developing a list of the likely threats or countermeasures against those components. These will be based on the component's detectability (emissions and signatures) or functions and the desire and capabilities of the enemy to detect/locate and to attack it (hard kill or soft kill); the information provided by all three communities, as described above, will be needed for these determinations. The system description and threat information should be developed in as much detail as possible, although it is recognized that some areas may not be definitively known, particularly early in the system

development process. In such a case, appropriate assumptions should be made, generic threats used or bounds of characteristics defined. Later the CCM analysis should be updated as more information is obtained. Some signatures that may be applicable to many types of equipment are listed in Table III.1. As an example of how the process might work for a specific item, the analysis group for the remotely piloted vehicle (RPV) developed the components and threat listing shown in Figure III. 2.

Some Equipment Signatures of Current Interest*

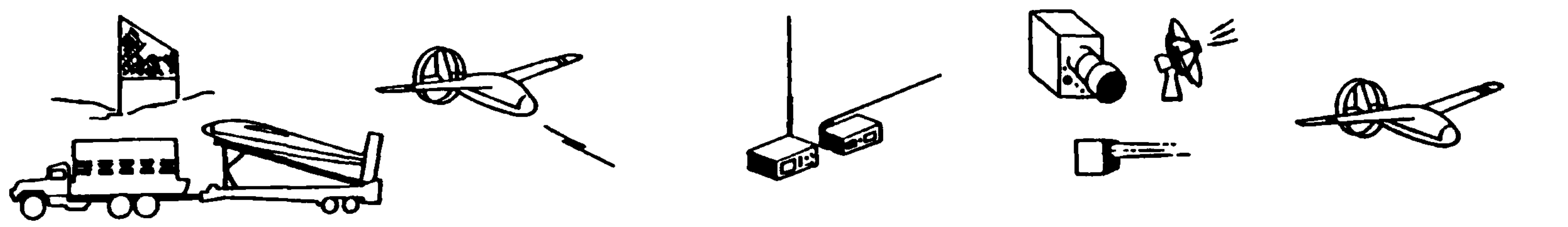
- Optical contrast with background
- Glint
- Muzzle blast and flash
- Image to IR seeker
- Vapor trail
- Image to radar
- Equipment noise
- Deliberate electromagnetic emitter characteristics
- Magnetic

Some Equipment Signatures of Possible Future Detectability*

- Image to laser radar
- Missile shock-heated air
- Unintentional electromagnetic emission
- Emissions chemically detectable

*Not comprehensive

TABLE III.1 SIGNATURES OF CURRENT AND FUTURE INTEREST



PHYSICAL SITE	DATA LINK	COMMUNICATIONS	SENSORS	RPV PLATFORM

NATURE OF THREAT

SURVEILLANCE	DF	DF	SMOKE	AIR DEFENSE SYSTEMS
TARGET ACQUISITION	JAMMING	JAMMING	LASERS	SEEKERS
ARM	NWE AND EMP	NWE AND EMP	RF JAMMER	RF
NWE AND EMP			CAMOUFLAGE	BALLISTIC ATTACK
BALLISTIC ATTACK			NWE AND EMP	NWE AND EMP
CHEMICAL AND BIOLOGICAL ATTACK				

Figure III.2 REMOTELY PILOTED VEHICLE: CRITICAL COMPONENTS AND COUNTERMEASURES

Technical Vulnerability

At this time, with the critical components, signatures and CM types identified, the analysis group, under the lead of the materiel developer, is ready to develop the system's technical vulnerability. By this is meant the determination of the vulnerability of each component when faced, in a tactically realistic manner, with each of the expected threats or CMs taken one at a time. For example, what is the technical vulnerability of the RPV data link to jamming or of the platform to air defense systems or of the sensor package to the enemy use of smoke?

In order to answer these questions several things must be known (or determined). First, the conditions under which the component will be employed must be known. For example, how far from the FEBA, how often, and for how long will it be operating? The answers to these questions may be obtained from the concepts of operation and mission profiles/operational mode summary previously provided by the combat developer, combined with the tactical (Red versus Blue) scenario in which these take place and the physical deployment of the system within that scenario. For purposes of standardization, it is strongly recommended that the scenario used be taken from the Scenario Oriented Recurring Evaluation System (SCORES) provided through the Combined Arms Combat Development Activity.

Second, the technical characteristics of the current and postulated threat over the entire life cycle of the system must be described in as much detail as possible. In addition, the intelligence community must work closely with the combat developers in developing the detailed threat arrays and tactics to be used in the scenario. When these items are not known, military judgment must be used in estimating them as well as possible; these estimates should be noted, and as the information later becomes available, the inputs and thus the outputs to the technical vulnerability analysis can be revised if required.

Third, the appropriate technical experts needed to perform the analyses must be assigned their specific analysis tasks. The technical analysis must begin by laying out the Red and Blue forces, determining the probability of Blue target location (or Blue target location error) given probability bands, what Red reaction is available (soft or hard kill), what reaction is taken (range of actions); and finally with what probable result. In order to accomplish this step, the group must start with the breakout of the components and their CM that were developed in the previous step. Each component-CM pair should then be individually assigned

to one or more particular DARCOM laboratories/assessment centers for analysis. For example, again referring to the RPV example (Figure III.2), the MERADCOM Camouflage Laboratory would be tasked to determine the technical vulnerability of the physical site to visual or optical enemy surveillance and target acquisition means; its vulnerability to antiradiation missiles (ARMs) would be assigned jointly to the ERADCOM Harry Diamond Laboratories (for specific ARM aspects) and the ARRADCOM Ballistics Research Laboratory (for general hardening aspects).

Figure III. 3 is a partial list of the assessment functions performed by selected DARCOM laboratories; a more complete listing is contained in Appendix C. It must not be forgotten, however, that although the laboratories may do the actual calculations of the numbers, they will need continual guidance and direction from the combat development and intelligence communities in setting realistic bounds on the scope of the problem. For instance, it does little good to calculate the vulnerability of a data link to sophisticated, computer-controlled imitative deception if the projected threat does not include such a technique; in fact, emphasis on such calculations may well obscure the importance of more realistic threats.

The laboratory technical expert will normally find it necessary to fight the system through its mission profile and tactical scenario in order to examine its technical vulnerabilities. That is, he will array the Red and Blue elements under consideration according to the scenario selected. He will then employ the system, according to its operational concept/mission profile, against each element of the threat at each event of its mission profile, in order to determine its specific vulnerability to that threat. This process will then be repeated numerous times, in order to generate bands of performance or ranges of probabilities for each scenario event. Here the guidance and assistance of the combat development and intelligence communities will be invaluable. For example, the vulnerability of the RPV data link to jamming is dependent on the relative distances between the enemy jammer, the RPV, the data link receiver, and antenna directivity as well as the relative powers of the jammer and the data link transmitter. The analyst must, therefore, know the physical locations of these items and how they perform their functions (combat developer's input), as well as the full technical details of the threat systems and how they perform their functions (intelligence community input).

ASSESSMENT FUNCTIONS

ERADCOM EWL (OMEW)		ERADCOM SWL	ERADCOM HDL	MERADCOM CAM LAB	ARRADCOM BRL	ARRADCOM CSL	ERADCOM NVEOL
ALL C-E SYSTEMS EXCEPT MISSILES STANO AVIONICS EO DEVICES	ALL MISSILE SYSTEMS EM EXCEPT COMM. MISSILE EXCEPT COMM. FIRE CONTROL & GUIDANCE ELECTRONICS MISSILE FUZES SEMI CM ARMY LEAD	SIGSEC	ARM CM HEL CM NUC WPNS EFFECTS EMP SEISMIC MAGNETIC SIGNATURES	COUNTER-SURVEILLANCE/ TARGET ACQUISITION	ARMOR/ HARDENING	CHEMICAL & BIOLOGICAL PROTECTIVE MEASURES	EO DEVICES

NATURE OF THREAT

C-E JAMMERS COMINT SYSTEMS ELINT SYSTEMS CAMOUFLAGE SMOKE EOCM	SMOKE CHAFF ELEC. JAMMERS AGAINST MISSILES SENSOR GUIDED WPNS EXCEPT ARM FUSE JAMMERS SEMI	SIGINT	HIGH ENERGY LASERS MAGNETIC MINES MAGNETIC SIGNATURES SEISMIC SENSORS ARMs NUCLEAR WPNS	SURVEILLANCE & TARGET ACQUISITION SYSTEMS	BALLISTICS	CHEMICAL & BIOLOGICAL WEAPONS	EOCM

Figure III.3 TECHNICAL VULNERABILITY ASSESSMENT ACTIVITIES

As indicated earlier, the product of the technical vulnerability step will be a series of charts, graphs and similar presentations of bands of performance or ranges of probabilities, pertaining to the various events of the system's mission profile/operational mode summary. These issues will be included in the item level system performance estimates and will be a prime input into the next step of the CM/CCM analysis process, or battlefield analysis. Although each of these bands or ranges, taken by itself, will only pertain to a single system component versus single CM, the technical analyst should bear in mind the possible synergistic effects occurring when multiple CM oppose the entire system. For example, the threat presented by an air defense system to the RPV platform may cause it to fly lower and/or in different areas than planned; this change may, by increasing the link distances, increase the vulnerability of the RPV-to-ground data link to RF jamming. The combination of two or more threats may thus be significant CM, although the system is relatively invulnerable to any individual threat. Although these synergistic effects will be specifically considered during the battlefield analysis step, the data prepared during the technical vulnerability analysis must be presented in such a fashion as to facilitate the follow-on analysis. To continue the example, both the air defense analyst and the jamming analyst must consider the system vulnerabilities across the same bands or ranges of altitudes and link distances.

In summary, the focus of technical vulnerability assessment is to determine in a one-on-one sense the reduced system performance resulting from the system-threat interaction, including the impact of CCM application. These reduced system performance numbers are then carried forward to the battlefield analysis where system performance is evaluated in a force-on-force sense to determine its impact on force peformance.

Battlefield Analysis

Once the individual vulnerabilities of the system's components to specific enemy countermeasures have been determined, the analysis group, under the leadership of the combat developer, is ready to combine them in a battlefield analysis of the many-on-many situation, i.e., in a complete scenario where the enemy sensors and CM efforts are concerned not just with one specific system, but with the totality of friendly units and systems acting in concert. This battlefield analysis combines the effects of the countermeasures against the system's components into their effects against the system as a whole and also determines the reduced system effect on force performance.

In order to conduct the battlefield analysis, the analysis group will need the results of the technical vulnerability analysis and the same arrays of forces, scenarios and mission profiles used earlier. The combat developers will also provide the tactics, doctrine and general order of battle used by the complete friendly forces; the intelligence community will provide similar information for the forces on the other side of the FEBA. Much of this will be the same information previously used in the technical vulnerability analysis, although additional data will be needed about forces and units more peripheral to the central problem and therefore not considered earlier. It is important, however, that all these inputs be consistent with each other, because each system must be assessed against consistent criteria to produce valid results. In other words, all the technical vulnerability analyses and the battlefield analyses must be done using the same scenario.

RPV: BATTLEFIELD VULNERABILITY

- Will the RPV be acquired by the enemy at launch?
- How?
- If acquired, what are the likely hostile reactions?
- With what effect?
- As it approaches the FEBA, what are the potential threats to its mission performance?
- Will its navigation system be confused?
- How?
- Will its data link be jammed?
- How?

Once again the postulated system will be combat tested in accordance with its proposed mission profiles or employment options. That will be done, this time, to determine its battlefield vulnerability when it and many other systems are employed against the array of hostile CM which may be used singly, in combination, or not at all against the system. That process is conducted throughout each full missio profile. During this step, hard data derived by the materiel developers during the technical vulnerability step will be available to the analysis group. They will have values or ranges of values for times, distances, probabilities, etc., which they can then use for an assessment of the vulnerability of the system against the array of threats.

Someday it may be possible to accomplish this battlefield analysis by means of a sophisticated computer model which would accept all these inputs, process them and then spew forth a printout showing when, where and how our system might succumb to the enemy countermeasures. Unfortunately, present-day computer models are not yet capable of fully treating the CM/CCM world. However, similar results can be obtained by the analysis group utilizing their military judgment and experience to walk the system through its mission profile or operational mode summary, pausing at each significant point to analyze the effects of the various signatures, actions and counteractions. A computer-assisted interactive wargame may be used to facilitate this process. That is, a computer loaded with the data resulting from the technical vulnerability analyses will support the battlefield analysis. In that mode, as the system is employed in the force-on-force wargame, the game may be stopped at any significant event (an engagement by a threat or combinations of threats, for example); the computer then processes the event (distance, angular rate, ballistics, visibility, etc.) and produces results (P_h, P_k, accuracy, etc.); those results are then analyzed and recorded; military judgments are made and the game proceeds to the next significant event. In fact, this partly manual processing of the information may well give the analysis group greater insight into the effects of the various countermeasures and thus of the relative worth of the proposed counter-countermeasures than would a fully computerized model.

Countermeasure/Counter-Countermeasure Alternatives

At this point, knowing which potential enemy countermeasures are effective or most effective against the candidate system, the analysis group is ready to examine counter-countermeasures that would improve the mission effectiveness of our system. The major inputs to this process, in addition to the

results of the battlefield analysis which was done in the previous step, are the combat developer's assessments of the utility of changes to the tactics and doctrine of employment of our system (tactical CCM) and the materiel development community's capability to devise technical means of countering (technical CCM) the enemy's CM.

In some cases, early in the analysis process, a particular technical or tactical CCM may be so simple or so obviously needed and obtainable that it is immediately agreed that the system should include it. For instance, it may be found that locating the RPV's launch complex 5 kilometers further behind the FEBA may greatly reduce its vulnerability to the enemy's target acquisition means and indirect fire weapons, while not significantly affecting its mission effectiveness. In that event, appropriate changes should be made to the system's technical and tactical parameters, and the CM/CCM analysis should be altered accordingly. In other cases, when the development of alternative means of CCM is delayed until late in the analysis process, it may prove valuable to repeat the analysis for various configurations of the system and its proposed CCM. In this way, insight can be gained into which of these alternatives is most effective, as well as examining the synergistic effect of several CCM applied simultaneously.

Analysis of Alternatives and Presentation to Decision Makers

A formal analysis of the cost-risk-benefit trade-offs associated with the adoption of the various proposed alternative CCM is now required. The object is to present to the decision makers, as early as possible, a clear assessment of the risks to the system posed by each likely countermeasure and the costs and benefits associated with each technical, tactical or combined counter-countermeasure. The objective is to make the CM/CCM analysis process a part of the COEA process. Even though the CM/CCM analysis must currently be done off line, its results will be incorporated into and become part of the Cost and Operational Effectiveness Analysis (COEA) which is presented to the decision makers for their consideration. In that way they will be able to make informed decisions as to the most effective way of spending their scarce resources to correct the CM problems.

PRODUCT TO DECISION MAKERS

THREAT/RESPONSE ANALYSIS:

ALTERNATIVES	COST	EFFECTIVENESS
A. Technical Solution	$\$^1$	E^1
B. Technical Solution	$\$^2$	E^2
C. Tactical Solution	$\$^3$	E^3
D. Tactical Solution	$\$^4$	E^4
E. Tactical/Technical Solution	$\$^5$	E^5
F. Tactical/Technical Solution	$\$^6$	E^6

Nonmajor Systems

In the preceding sections, we have talked of computer-assisted wargames, formal trade-off analyses, and other methods primarily appropriate to the development of CCM for major systems. The CCM analysis methodology for nonmajor systems is different only in degree, not in substance. The same steps would be followed, although the analysis may rely more on military judgment and less on computers. It may not be possible to have as many face-to-face meetings with as many people present, but the same inputs and coordination should take place. The same interaction among the participants, i.e., TRADOC, DARCOM and INSCOM, is still essential to assure that the nonmajor system will perform as desired in the threat environment. In summary, the process for nonmajor systems is merely a scaled-down version of that presented above.

Summary

It is a well-established principle that any weapon system can be countered. A corollary to that premise states that for every countermeasure, a counter-countermeasure can be devised. It is the job of the CM/CCM analyst to examine that system for areas potentially subject to attack (CM) and to devise counters (CCM) to that attack. It is the responsiblity of the materiel and combat developers and the intelligence community to ensure that appropriate CCM, either technical or tactical, are included so that the system will be mission effective in the expected battlefield environment. The systematic consideration of CM and CCM, using the methodology presented in this chapter, will help them to fulfill that responsibility.

CHAPTER IV

TECHNICAL ASSISTANCE

Most managers, staff and project engineers involved in the materiel acquisition process will not be experts in the technical aspects of each CM or CCM. The initial evaluation of a system's signatures, potential countermeasures against it and the corresponding counter-countermeasures will be done by these managers and their staffs. These individuals, with their breadth of knowledge and experience, will provide a much-needed overview of the field. However, there are many aspects of CM and CCM in which detailed technical expertise is a must. The actual technical development and evaluation of the signatures, enemy CM and CCM should normally be referred to the laboratories and other agencies that have the required expertise.

The first step in obtaining this technical assistance and expertise is to identify, as exactly as possible, the area in which assistance is needed. Is it defining the threat or evaluating the impact of a known threat on our system or developing a technical counter-countermeasure technique against that threat? Once these questions are answered, the source of the needed assistance may be determined.

Appendix C contains a listing with addresses and telephone numbers of the various laboratories and their areas of expertise. It also includes other agencies from which technical assistance may be obtained. In the event that assistance is needed in a field not listed in the appendix, or if questions arise which cannot be answered by any of the listed agencies or activities, assistance should be obtained from

DARCOM CM/CCM Office
USA ERADCOM
Attn: DRDEL-CCM
2800 Powder Mill Road
Adelphi, MD 20783
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CHAPTER V

THE PRECONCEPT PROCESS

Hostile countermeasures to a conceptual system or device should receive active consideration by the combat and materiel development communities as early as possible in the life of each system or device. In fact, we would suggest that the subject of potential CM should play a role in the life cycle of any new system long before it has taken any form or shape; that is, when it is little more than a glimmer in the eye of the activities which will ultimately give it birth. During that period before the formal initiation of the materiel acquisition process for a new system or item of equipment, a number of closely interrelated, ongoing actions feed the materiel and combat development activities in a continuous fashion. For the purposes of this handbook, that flow of actions is called the Preconcept Process and is depicted in Figure V.1. It culminates in the TRADOC effort, also continuously ongoing, called Mission Area Analysis (MAA). MAA, in turn, results in the development of the MENS for major systems requiring DOD approval or other requirements documents, e.g., LOAs, for nonmajor systems.

Mission Area Analysis

MAA is carried out at each of the TRADOC schools/centers and entails a continual review of those forces or mission elements which have an existing or projected deficiency, the countermeasures to be faced by those mission elements or forces and available (or soon-to-be-available) technology. Existing or projected deficiencies are determined by the mid-and long-range studies conducted by TRADOC and the Concepts Analysis Agency (CAA), respectively, and from the experience and knowledge of the user community. Threat information for MAA is provided by the TRADOC school/center Threat Manager (TM) based on information previously made available from INSCOM and other national sources, in many cases in response to Intelligence Production Requirements. (Similarly threat information is provided to TRADOC and CAA for their mid- and long-range studies from the same sources and likewise in response to Intelligence Production Requirements.) The existing or near-term technology, including CCM technology, considered during MAA is that which forms a part of the Army technology base plus that developed by industry, other services, other nations, etc. The DARCOM

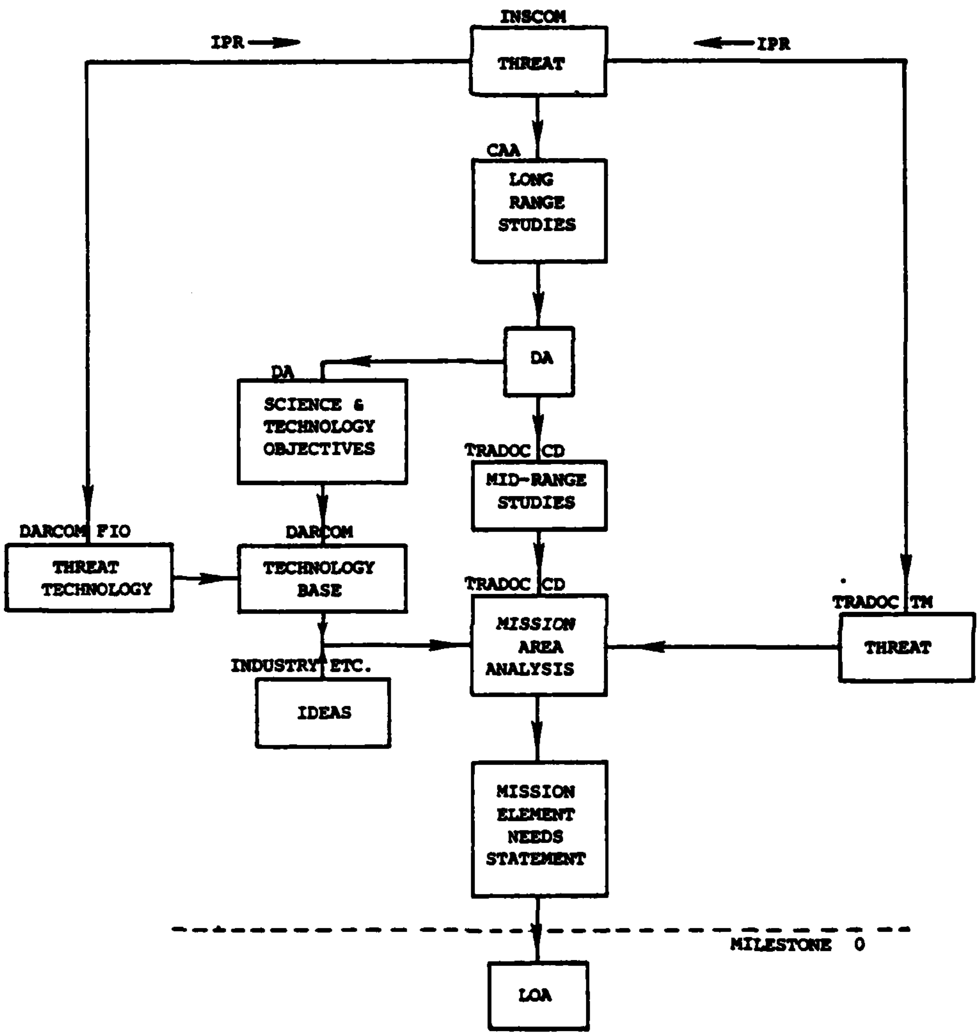

Figure V.1 PRE-CONCEPT PROCESS

Foreign Intelligence Officers (FIO) will participate in the development of the technology base by providing information to the R&D commands and laboratories regarding the technical characteristics and capabilities of potential enemy countermeasures. The FIO will obtain that information from DARCOM sources (FSTC, MIA) and/or through INSCOM.

Science and Technology Objectives

The Army's technology base is developed as a result of the efforts of DARCOM's R&D commands, laboratories and the private sector. These efforts receive guidance from the Science and Technology Objectives (STO) which are published annually by Headquarters, Department of the Army, in the Science and Technology Objectives Guide (STOG). That document provides the direction in which to advance technology or to seek scientific break throughs to meet the Army's needs, including CCM needs. The STO are derived also from the TRADOC and CAA mid- and long-range studies and provide guidance for expenditures on Basic Research (6.1), Exploratory Development (6.2) and Nonsystems Advanced Development (6.3a). The STO and the resultant technology base provide the Army with a head start on the development of new capabilities well before a materiel concept is initiated and eliminate the need for a "start from scratch" when the need for a new technology system or force capability is recognized.

Interaction

One can see that the materiel development and combat development activities which are carried out as part of the Preconcept Process are highly interactive. TRADOC and CAA studies contribute both to the conduct of MAA and to the development of the STO. The STO guide the development of technology whose adequacy and applicability are analyzed in the MAA process. Threat is introduced into the study process, the technology base process and the MAA process.

Role of Threat in the Preconcept Process

Because the focus of this document is on CM, i.e., threat, and CCM against the threat, it may be of value to trace specifically the use of threat and the role of INSCOM in the technology base process. A frequently heard criticism of the activities carried out in the Preconcept Process is that they are unrelated to the threat or at least not related to it closely enough. Figure V.1 illustrates

that the intelligence community—in this case consisting of INSCOM, TRADOC and DARCOM elements—in fact, does play a very direct role. For example, threat influences the development of the technology base in two ways. First and most directly is the interaction between the FIOs and the R&D commands and laboratories. As mentioned previously, the FIO advises those activities on the technical characteristics and capabilities of threat systems and devices. Thus, if the Night Vision Electro-Optics Laboratory, for example, is working on new technology to improve the Army's night vision capabilities, the Fort Belvoir FIO would provide NVEOL with information regarding the enemy's current and potential technical capabilities to blind the developmental technology. Lacking sufficient information, the FIO will canvas other DARCOM sources, i.e., other FIOs, FSTC or MIA, or will go to INSCOM if the needed information has not been found. The night vision device developer, now having information regarding the technical threat (CM), will attempt to develop technological approaches to reduce or negate the threat; that is, he will develop technological CCM.

The second way in which the intelligence community influences the development of the technology base is by the provision of threat information for the mid- and long-range studies. Those which deal with force effectiveness and related materiel issues directly influence the STO and, therefore, the technology base. Thus, threat assists in the derivation of objectives for the Army scientific and technological community, and threat helps guide laboratories to develop CM-resistant technologies.

In each of these two cases, INSCOM provides threat information to the FIOs or to the study activity (through its own threat agency) when the needed information is not available. In these cases, INSCOM plays an indirect role, providing advice and assistance as required for the conduct of the study and technology base processes. As can also be seen from Figure V.1, INSCOM performs a similar, indirect role during MAA.

Problems in the Threat Process

The principal problems in the threat process are in the provision of system specific threat information during the materiel acquisition process, particularly during its early stages when the requirement for a new system is being defined, i.e., during the period between development of the MAA and approval of the LOA. The materiel and combat developers insist that

- The threat must be provided in a timely fashion to permit its use early in the developmental process.
- It must be complete in technical detail to permit technical assessments of the susceptibilities of the total system.
- It must be projected to include the lifetime of the system from development through retirement.
- The threat, which will change during the developmental process, must be integrated into that dynamic process to provide an update of the total system capability during its development.
- Better feedback is required among the technical, tactical and intelligence communities.

The intelligence community responds by identifying problems within the combat and materiel development processes:

- It takes time to generate the threat information; requirements for that information must be made known well in advance.
- In the early stages of materiel acquisition, a system is too ill-defined to have its own technical details determined, much less the technical details of the threat.
- Tactical and organizational aspects of the threat may be projected with a high degree of reliability; it is far more difficult to project hostile technology and its potential applications.
- The combat and materiel developers define a system and, later, change it drastically during its development.
- The combat and materiel developers' questions are not sufficiently specific to serve as a basis for the development of adequate and detailed threat information.

Resolution of the Problems

It appears that the majority of the problems cited above are amenable to solution. The TRADOC and CAA mid- and long-range studies which identify or project mission element and force effectiveness needs should be provided to INSCOM to form a basis for future threat requirements (see Figure V.2). These two groups of studies drive both the MAA process and the development of the technology base. INSCOM should analyze these studies to determine areas

of Army interest regarding future deficiencies; this analysis will provide INSCOM prior notice of potential materiel developments to resolve those materiel or force needs and a framework for future intelligence/threat requirements. Using these mid- and long-range studies to predict threat requirements will assist in the resolution of the identified problems as follows:

- With prior knowledge of potential materiel development plans, INSCOM will be able to provide the system specific threat in a much more timely fashion.
- Given time to analyze the requirement and prepare the threat, greater technical detail or at least a range of technical performances of threat equipment should be available.
- By using projected Army force capabilities as a basis for research and analysis, the problem of projecting the threat should be reduced.
- The mid- and long-range studies should serve as a firm basis for dialogue and feedback between the intelligence community and the combat/materiel developers so that the latter's questions and threat needs will be much more clearly focused and specific.

Of greatest significance, by using this procedure as part of the Preconcept Process, INSCOM will be directly, rather than indirectly, involved in the front end of the technology base program and the materiel acquisition process. The adoption of this procedure will bring the threat preparation process much more in line with the content of paragraph 2-10 of AR 1000-1, which says in part,

> Consideration of threat and its implications for materiel development must be continuous throughout the life cycle of Army systems. To provide time for necessary research and analysis, <u>early identification of requirements for threat evaluation is of particular importance.</u> (Emphasis added).

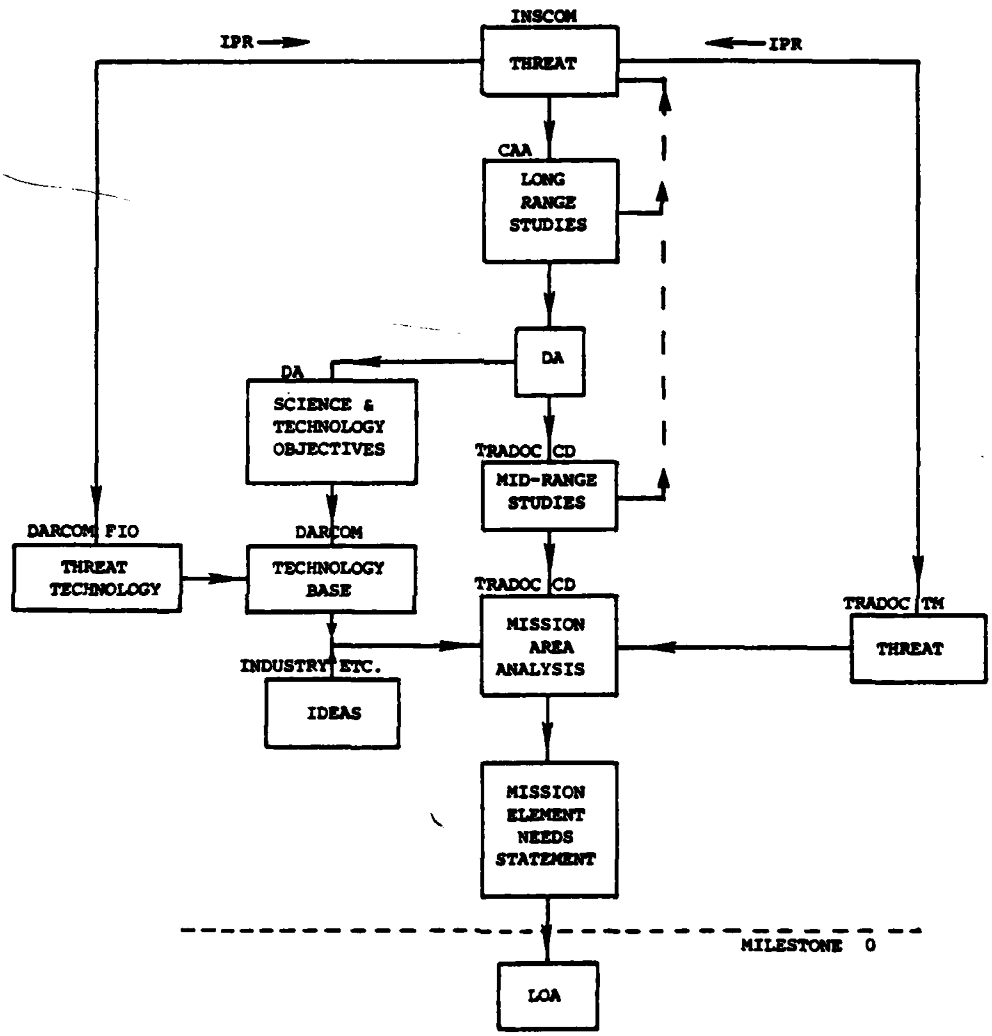

Figure V.2 PRE-CONCEPT PROCESS - MODIFIED

CHAPTER VI

THE ROLE OF THE PARTICIPANTS

The material in this chapter forms the heart of this handbook. It presents the specific functions of selected players in the materiel acquisition process during the most important (from a CM/CCM standpoint) events or milestones during that process. It is organized according to the matrix shown in Figure VI.1.

As can be seen, the columns of the matrix represent events within the system life cycle. Some events happen repetitively; for example, DT I is followed by DT II, which may be followed in turn by DT III. Similarly, an Outline Acquisition Plan is prepared for a system to support its entry into the demonstration and validation phase. As the system progresses, the OAP is updated and fleshed out, until it becomes an Acquisition Plan when the system enters full-scale engineering development. Since the actions of the players are basically very similar for each iteration in such a series, those events are listed only once on the matrix. Unless noted otherwise, it may be assumed that a single column refers to all the events of such a repetitive series. As can be seen, the first subsection (numbered X.0) listed in each column is a general explanation of the event itself; here also can be found references to the corresponding Army regulations.

The remaining numbers within each column refer to the particular subsection within this chapter which explains the specific CM/CCM role of that participant during the event in question. For example, the role that the TRADOC CM/CCM Office plays during the preparation of a Letter of Agreement is found in subsection 1.1. As can be seen, the matrix organization allows easy reference to the role of a given organization throughout the materiel acquisition process; by reading across, one can see that TRASANA's role, for example, is described in subsections 3.5, 4.1, 5.3, 6.1 and 8.5. Furthermore, by reading down the columns, one can easily find reference to all the subsections referring to a given event in the life cycle process.

	LOA	CFP	COEA	DT	OT	Other Testing	(O)AP	Decision Points	ROC/LR
General	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
TRADOC Elements									
CM/CCM Office	1.1		3.1					8.1	9.1
CAC	1.2		3.2			6.1			
School/Center	1.3	2.1	3.3	4.1	5.1	6.1	7.1	8.2	9.2
TSM	1.3	2.1	3.3	4.1	5.2	6.1	7.1	8.3	9.3
Threat Manager	1.4	2.2	3.4	4.2	4.2	4.2	7.2	8.4	9.4
TRASANA			3.5	4.1	5.3	6.1		8.5	
Test Activity			3.6	4.1	5.4	6.1		8.6	9.5
STF/SSG	1.5	2.1	3.3	4.3				8.7	
DARCOM Elements									
CM/CCM Office	1.6		3.7	4.4				8.8	9.6
R & D Command	1.7	2.1	3.8	4.5	5.5	5.5	7.3	8.9	9.7
PM			3.8	4.5	5.5	5.5	7.3	8.9	9.8
FIO	1.8	2.2	3.4	4.2	4.2		7.2	8.4	9.9
TECOM			3.6	4.6	5.5	5.5		8.6	9.5
AMSAA	1.9		3.9	4.7	5.5	5.5		8.10	9.10
INSCOM Element									
ITAC	1.10	2.3	3.10	4.8	4.8	4.8	7.4	8.11	
OTEA	1.11		3.6	4.9	5.6	6.2		8.6	9.5

Figure VI.1 PLAYERS AND EVENTS IN THE MATERIEL ACQUISITION PROCESS

Participating Organizations

The principal players in the CM/CCM process are

TRADOC Elements:

- CM/CCM Office - This office is organizationally an element of the Combined Arms Center. It serves as the executive agent for Commander,TRADOC, with respect to countermeasures/counter-countermeasures.
- Combined Arms Center - The functions listed in this row are those related to the CAC role as an integrating center. The CAC functions related to the roles as a proponent (for C^3) and as a CM/CCM focal point are listed separately.
- Proponent School/Center - This is the school/center designated by HQ TRADOC to take primary responsibility for all combat development actions related to a particular system or family of systems. (The responsibilities of CAC for C^3 systems will be found here.) In the event that no proponent has been designated, the proponent's functions will be performed by HQ TRADOC.
- TRADOC System Manager - The TSM is designated by HQ TRADOC to integrate all user requirements and actions throughout the acquisition cycle of a particular system or family of systems. If a TSM has not been designated, this function will be performed by the proponent school/center.
- Threat Manager - This is the individual or staff element at each school/center designated to be the single point of contact for all matters pertaining to the validity of the threat. Threat support will be provided to the materiel acquisition process as prescribed by AR 381-11 and shown in Figure VI. 2.
- TRADOC Systems Analysis Activity-TRASANA is the TRADOC center of analytical excellence; in particular, it conducts countermeasures/counter-countermeasures analyses on selected programs or systems.

- Test Activity - This term refers to the various test boards, TCATA, CDEC or other agencies (except OTEA) which conduct user testing.

STF/SSG: A special task force, special study group or special steering group may be formed at any time to undertake tasks that require the concentration of special expertise for a short time. In the context of this handbook, a prime example of such a task would be to manage the development of a conceptual system prior to the appointment of a PM or TSM. STF/SSG should normally include representatives from DARCOM, TRADOC and INSCOM, plus other agencies or commands as appropriate.

DARCOM Elements:

- CM/CCM Office - This office is organizationally part of the Electronics Research and Development Command. It serves as the DARCOM management focal point for all counter-countermeasures.
- The Research and Development Commands - These commands have the mission of performing, conducting or managing the research, development and initial acquisition of their assigned categories of materiel. These functions are frequently referred to as those of the materiel developer.
- Program/Project/Product Managers - These are individuals specifically tasked and staffed to provide centralized management of the development and/or acquisition of a specific materiel item or system. The PMS thus assumes many of the functions of the materiel developer. The terms PM and Project Manager refer to all Program/Project/Product Managers.
- Foreign Intelligence Office (Officer) - An FIO is established at each major DARCOM subordinate command and at selected separate installations and activities. It obtains and provides foreign intelligence and threat data required by the activity

Threat Support Action / System	Threat Requester	Prepare Threat	Produce Threat	Validate Threat	Approve Threat	Evaluate Threat	Threat Guidance
Major	TM,FIO & PM for produc- tion	N/A	INSCOM	INSCOM	ACSI	DIA	
Designated Non-Major	TM & FIO for guidance	TM & FIO jointly*	N/A	INSCOM	N/A	N/A	INSCOM
Non-Major	TM & FIO for guidance	TM & FIO jointly*	N/A	HQ DARCOM HQ TRADOC	N/A	N/A	INSCOM
Other Materiel Systems	Proponent's local intel support ofc.	Proponent's local intel support ofc*	N/A	HQ DARCOM HQ TRADOC	N/A	N/A	INSCOM

*Based on DA/DIA validated threat and intelligence.

Figure VI.2 THREAT SUPPORT TO MATERIEL ACQUISITION

represented and coordinates the provision of threat support from other elements of the intelligence community as necessary. Threat support will be provided to the materiel acquisition process as prescribed by AR 381-11 and shown in Figure VI.2.

- Test and Evaluation Command - TECOM plans, conducts and reports the results of the government portions of development testing (DT) I, II and III (if required). TECOM also acts as the evaluator of DT for selected major and Category 1 nonmajor systems, as well as for all Category 2 and below nonmajor systems; however, the DT evaluation function in this handbook is addressed in the AMSAA paragraphs.
- U.S. Army Materiel Systems Analysis Activity - AMSAA is the DARCOM center of expertise for developing and providing to Army elements, through DARCOM, a base of information on and understanding of materiel system performance and effectiveness, primarily through item level technical analysis. AMSAA is charged with designing tests and performing independent evaluations of major, nonmajor and selected other systems. Countermeasures are appropriate and solicited issues for inclusion in AMSAA independent evaluations. AMSAA is also the DARCOM lead activity for survivability; as such, chemical, biological and nonnuclear hardening and the vulnerabil-ity/survivability of Army forces fall under its purview.

INSCOM Element:

- Intelligence and Threat Analysis Center - This is the element within INSCOM which directly develops and produces foreign intelligence and threat data in support of major materiel systems acquisition programs. In addition, ITAC provides guidance and assistance to the TMs and FIOs who prepare the threat documentation in support of nonmajor system acquisitions. Threat support will be provided to the materiel acquisition process as prescribed by AR 381-11 and shown in Figure VI. 2.

OTEA: The U.S. Army Operational Test and Evaluation Agency exercises responsibility for all Army operational testing (OT) and manages force development testing and experimentation (FDTE). OTEA normally conducts and evaluates the OT of major and Category 1 nonmajor systems and supervises and provides guide for the conduct and evaluation of OT for Category 2 and below nonmajor systems.

1.0 LETTER OF AGREEMENT

The LOA is a requirements document jointly prepared and authenticated by the combat and materiel developers. It ensures their agreement on the nature, characteristics and procedures to be used in development of a new system and is the document of record to support effort in the demonstration and validation (6.3) phase of the RDT&E program.

If the system under development is a major system, a MENS (Mission Element Need Statement) will normally have been written for approval by the Secretary of Defense. This approval initiates the materiel acquisition process, and is called Milestone 0. An LOA will then be prepared to further refine the alternative system concepts contained in the approved MENS. Since Headquarters DA will normally designate a special task force/study group/steering group (STF/SSG) or study advisory group (SAG) to manage the early development of major systems, that body will normally develop and/or review the LOA and its critical issues. These critical issues will then be used in developing the concept formulation package (see paragraph 2.0).

Nonmajor systems do not normally begin their development in such a formal manner. Here the first step is frequently the formation of a joint working group (JWG), with TRADOC and DARCOM representation, to develop the LOA. Depending on the system's cost, importance and complexity the LOA approval authority may direct that an STF or SSG assume the system management. If so, the STF/SSG will review the LOA for critical issues.

In the event no STF/SSG is formed, the TRADOC LOA proponent will staff the document to DARCOM, TRADOC and INSCOM for determination of critical issues. Upon receipt of comments, the LOA and list of critical issues will be provided to the materiel and combat developers for use in the trade-off determination (TOD) and trade-off analysis (TOA).

Further details and instructions for the preparation and coordination of a Letter of Agreement are contained in AR 71-9 and the AMC-TRADOC Materiel Acquisition Handbook. A summary of the format of an LOA is in Figure VI-1.1.

1. Need
2. Operational Concept
3. System Description
4. Prospective Operational Effectiveness and Cost
5. System Development
6. Schedules and Milestones
7. Funding

Annex A. Operational Mode Summary/Mission Profile
Annex B. Coordination Annex
Annex C. Threat Annex
Annex D. Rationale Annex
Annex E. RAM Annex

Figure VI.1 FORMAT FOR LETTER OF AGREEMENT

1.1 TRADOC CM/CCM Office

When the TRADOC CM/CCM Office provides a representative to the JWG, he will assist the proponent in identifying potential CM and possible CCM requirements. Furthermore, the LOA will be reviewed by the CM/CCM Office as part of the staffing process at the TRADOC Combined Arms Center. The early participation of this office in the CM/CCM analysis and LOA preparation will expedite this staffing and approval.

1.2 Combined Arms Center

CAC, because it is an integrating center, will normally review most LOAs before forwarding them to HQ TRADOC. Additionally, CAC provides guidance and assistance to the TRADOC Threat Managers in their preparation of threat documentation; this is applicable whenever INSCOM/ITAC is not the threat production agency. For these reasons, it will frequently be appropriate for CAC to provide representation to the JWG preparing the LOA, particularly for systems that impact more than one combat area/proponent.

1.3 Proponent School/Center/TSM

The TRADOC proponent school/center or the TSM, if appointed, will normally be designated to convene and chair a JWG to draft the LOA. The convening authority should ensure that the appropriate DARCOM R&D command, AMSAA, INSCOM/ITAC, the TRADOC and DARCOM CM/CCM Offices, CAC, USALOGC and DA DCSOPS are invited to participate. Test activities should also be invited if significant test requirements are apparent at this time.

The proponent's CM/CCM role when writing this LOA is to

a. Ensure that an initial CM/CCM analysis of the system, as described in Chapter III, is performed and that the results of that analysis are available to the JWG. The CM/CCM analysis group may be the JWG itself or a subgroup of the JWG or a group specially formed for that purpose.

b. Include a detailed discussion of the expected countermeasures (threat) to the system in Annex C and a summary of that information in paragraph 1 of the LOA. This discussion should also include the postulated response threat.

c. Include the tactical CCM which have been identified by the CM/CCM analysis group in Annex A and paragraph 2 as appropriate.

d. Include the proposed technical CCM in paragraph 3 of the LOA.

e. Ensure that the remainder of the LOA is consistent with the CM/CCM information included as described above.

1.4 TRADOC Threat Manager

The TM will be the primary source of threat information in support of the proponent school/center and TSM. If he cannot answer their questions within his own resources, he will request assistance from INSCOM and/or the appropriate FIO. If present at the JWG, the TM will work with the INSCOM and FIO representatives to develop threat information for inclusion in the LOA. He will also ensure that the FIO is aware of tactical and operational CM threats to the developing system as they jointly develop their LOA input.

1.5 STF/SSG

At approximately the time that the LOA is being prepared by the JWG, an STF/SSG may be convened to serve as proponent for the conceptual system. Normally, the STF/SSG will remain in existence until a TSM has been appointed--perhaps a period in excess of a year, during which time much of the front end work will be carried out. The STF/SSG will analyze the LOA for critical issues, prepare the initial organizational and operational concept, analyze the merits of alternative system concepts, and provide direction and guidance (and, perhaps, participation) in the initial COEA and decision reviews as required, i.e., IPRs, ASARCs and DSARCs. At this particular stage it is of utmost importance that appropriate STF/SSG membership be established. While that membership may vary widely according to the system concepts under consideration, in all cases an INSCOM representative (for major systems) should be provided by name. Whether as a full-time or part-time participant, that representative should be totally involved with the STF/SSG activities and should remain identified with the system through the developmental process. He will serve to orchestrate the activities of the threat-related participants (TMs, FIOs) and will be responsible for preparation of the threat in technical and tactical detail. He will also estimate the most likely and reasonable enemy reactions to the conceptual system. For nonmajor systems

that same function should be carried out by a specifically designated Threat Manager who should work closely with the FIO from the appropriate DARCOM R&D command.

1.6 DARCOM CM/CCM Office

When the DARCOM CM/CCM Office provides a representative to the JWG, he will assist in identifying potential CM and possible CCM requirements. By virtue of his experience and expertise, he will also be a particularly useful member of the CM/CCM analysis group.

1.7 DARCOM R&D Command

The DARCOM R&D command's CM/CCM role in the LOA process is to

a. Ensure that the FIO coordinates closely with TRADOC and INSCOM/ITAC to obain the best possible threat support to the JWG.

b. Coordinate with the FIO and INSCOM/ITAC to ensure that the technological alternatives identified as having a reasonable chance of developmental success are also desirable with regard to reducing threats of CM or easily countering CM. The R&D command may task the appropriate laboratory to provide additional technical support/expertise. (See Appendix C of this handbook.)

c. Ensure that CM/CCM related events such as vulnerability assessments, experimentation and force-on-force modeling are considered and included in paragraphs 5 and 6 of the LOA if appropriate. Additionally, any significant cost generated by the inclusion of CCM will be incorporated in the paragraph 7 funding estimates.

1.8 Foreign Intelligence Officer

If in attendance, the FIO participates in all threat and CM related activities in the JWG. The FIO provides input to the R&D command representatives concerning the technical threat and assists the INSCOM/ITAC and TRADOC representatives to identify potential CM. He coordinates with the TRADOC TM to ensure that both have an adequate understanding of the technical threats to various operational system concepts and a clear understanding of user needs.

1.9 U.S. Army Materiel Systems Analysis Activity

As DARCOM lead activity for survivability, AMSAA will participate in developing the LOA. AMSAA will assist the R&D command representative to analyze the technical and operational suitability of various approaches to potential problem areas, including CM/CCM, for inclusion in appropriate sections of the LOA. AMSAA will also assist in developing input to the schedule portion of the LOA with regard to DT, evaluation of test results and vulnerability assessments.

1.10 ITAC

ITAC, under INSCOM, has overall responsiblity for developing all threat and potential CM information for major systems. It is particularly important that the threat (CM) be projected throughout the potential lifetime of the system. ITAC must ensure that all appropriate intelligence sources have been consulted in supporting development of the LOA. For nonmajor systems, the ITAC role will be to validate the work of the JWG rather than to participate actively; however, ITAC may attend and participate in nonmajor system Joint Working Groups if appropriate. ITAC will also help develop the schedule for the production of threat documents and must be prepared to participate in the CM/CCM assessment portion of the COEA.

1.11 *Operational Test and Evaluation Agency*

OTEA representation may be solicited for the JWG in order to project resources and facilities for OT and to help develop the scheduling section of the LOA. OTEA participation will assist in ensuring that CM/CCM issues are understood and that test requirements can thus be adequately planned. What might otherwise be an adequate area or location for testing may not be capable of providing a realistic threat environment in which to test potentially critical CM/CCM issues. OTEA attendance at the JWG will also be valuable later in the acquistion process when operational test plans and requirements are developed.

2.0 CONCEPT FORMULATION PLAN (CFP)

The CFP supports the content of the Decision Coordinating Paer (DCP) or Army Program Memorandum (APM). It is the responsibility of the STF/SSG, but its preparation is generally delegated to DARCOM, TRADOC and INSCOM elements as discussed below. The CFP consists of four parts: Trade-Off Determination, Trade-Off Analysis, Best Technical Approach and Cost and Operational Effectiveness Analysis. The COEA, although it is a part of the CFP, is discussed separately in section 3.

The TOD is conducted to assess the performance, cost, risk and schedule factors of each approach to meeting the military requirement. Data for the TOD is compiled from earlier studies, the technology base program and documented experimentation. The TOA is an analysis of the trade-offs in the TOD from the user/trainer/logistician viewpoint. In the context of this handbook, it is a review of technical CCM alternatives to determine their impact on the combat effectiveness of the conceptual system, the ability of the Army to train for their use and considerations of their supportability, reliability and maintainability. The BTA is based on the TOD, TOA and other analyses of technical approaches; it identifies the best general technical approach. The full CFP is prepared only once, during the exploration of alternative systems concepts; however, the COEA is prepared or updated during each phase of the materiel acquisition process.

2.1 Proponent School/Center/TSM/STF/SSG/R&D Command

The STF/SSG has the responsibility for the conduct of the TOD, TOA and BTA. Frequently, however, the TOD will be delegated to DARCOM, the TOA to TRADOC and the BTA to DARCOM and TRADOC jointly. DARCOM and TRADOC may further delegate those events to the appropriate R&D commands and the proponent school/center. For TOD the R&D command should ensure that appropriate CCM have been included in the conceptual system. The R&D command will also conduct studies and analyses as tasked by the STF/SSG and will supervise the efforts of the appropriate laboratories in the conduct of technical assessments for signature reduction, susceptibility analysis and the development of appropriate CCM. For TOA the TRADOC proponent/TSM should ensure that the user/trainer/logistician viewpoints are included in the assessment of the threat to

the conceptual system as well as the technical CCM needed to ensure its effectiveness on the battlefield.

By the time the BTA is conducted, the system under consideration is beginning to assume specific technical characteristics. General bands of performance and signature characteristics can be measured and reduced or modified depending upon the results of the previous analyses, including analyses of the threat. For purposes of threat analyses the proponent TM and the R&D command FIO should be deeply involved to help define the tactical and technical nature of potential countermeasures against the conceptual system. In addition, the STF/SSG (or INSCOM/ITAC, if so delegated) will include in the CFP covering letter (or STF/SSG report accompanying the CFP) a description of the threat environment in which the system will operate. That description should include both the projected and reactive threats to the system throughout its operational lifetime.

2.2 TM/FIO

During these events, the TM and FIO will provide threat support to their respective commands and their subordinate elements. The threat must include both technical and tactical aspects and must be projected in as much detail as possible for the life of the conceptual system. It is important that the TM and FIO both work from the same threat in a closely coordinated effort. For threat projections and other required information, INSCOM/ITAC support will be required.

2.3 ITAC

ITAC should provide representation on the STF/SSG. That representative must assure that current and projected threat information is available to the STF/SSG and that it is used appropriately by that group and all tasked agencies. In addition, if tasked by the STF/SSG, ITAC will prepare a description of the environment in which the conceptual system will operate. That description will be a part of the STF/SSG covering letter or report and should include both the projected and reactive threats to the system throughout its operational lifetime. ITAC will also respond as required to Intelligence Production Requirements forwarded by the materiel and combat developers and will provide guidance and assistance to the TM and FIO as needed.

3.0 COST AND OPERATIONAL EFFECTIVENESS ANALYSISS

A COEA is an analysis of the costs and operational effectiveness of each of several alternative courses of action (in this case, system concepts) which is used to assist the decision makers in arriving at sound and logical judgments. Because COEAs provide the primary vehicles to assist the decision makers in the materiel acquisition process, a COEA is conducted during each phase of that process to support each subsequent decision point. The first COEA is carried out during the exploration of alternative system concepts, to support Milestone I, the decision whether to proceed into system demonstration and validation. The initial COEA is a very important one; if it is done well, the COEAs conducted at each subsequent decision point may be limited to updating. The second (D&V) COEA supports Milestone II, the decision point for entry into full-scale engineering development and, likewise, the third (FSED) COEA is used for Milestone III, the decision whether to enter into production and deployment. As the developmental system proceeds through the materiel acquisition process, more details of its performance, capabilities, technical characteristics and operational employment become known; therefore, each successive COEA becomes more specific regarding its cost, performance and effectiveness.

A principal difficulty encountered in the COEA process, particularly in the initial COEA, is the definition of the threat to the developmental or conceptual system. That difficulty is encountered because the threat must be projected for the lifetime of the system--a period perhaps in excess of 20 years from the time of the initial COEA. Current hostile doctrine, tactics and organizations are fairly well understood and can be projected with a relatively high degree of probability; however, far less is known of the potential application of technology to future systems which may be used to counter our conceptual or developmental system. Although future enemy technical capabilities are not as well known, there are ways to make reasonable projections. Regardless of the method by which the threat is developed, it is revised/updated for use in each successive COEA. A major change in the threat is one of the factors that can result in the requirement for a complete redoing of the COEA at any given phase. From the above discussion it becomes apparent that INSCOM should play a major role in the COEA process along with DARCOM and TRADOC. Representatives of

all these commands should serve on the STF/SSG which guides the initial COEA, and both INSCOM and DARCOM should be consulted continuously during the conduct of subsequent COEAs.

3.1 TRADOC CM/CCM Office

The TRADOC CM/CCM Office should be represented on the STF/SSG, SAG or COEA Review Board to ensure that CM/CCM issues are adequately addressed in the COEA. Such participation will also expedite the subsequent review of the COEA by CAC. As required, the CM/CCM Office may task TRASANA to perform analyses relating to CM/CCM issues for inclusion in the COEA.

3.2 Combined Arms Center

As an integrating center, CAC will normally review all COEAs. An important part of the review will be a determination as to whether the COEA accurately portrays the system's operation in a realistic CM environment and includes appropriate CCM. Additionally, CAC will review the threat input used in the COEA, focusing upon the correctness, completeness and accuracy of the portrayal of threat tactics, doctrine and techniques. If either document is found to be inadequate, it will be returned to its originator for correction.

3.3 *School/Center/TSM/STF/SSG*

Although COEAs will nominally be the responsibility of the STF/SSG, they will frequently be delegated to TRADOC which, in turn, will task the proponent school/center for their preparation. The element with the primary responsibility for the conduct of COEAs will normally receive assistance in the analytical effort from TRASANA as the supporting analytical agency. The TSM, if appointed, will coordinate and orchestrate the activities of the various participants in the process.

For major and designated nonmajor systems, INSCOM/ITAC will prepare, validate and update the threat. The COEA agency must notify INSCOM of that requirement well in advance and define, in as much detail as possible, the technical and tactical aspects of the developmental system, its intended purpose, concept of employment and required technical and tactical threat information. In the case of nonmajor systems, the COEA agency will task the local TM, who will prepare and update the threat while working in close coordination with INSCOM/

ITAC and with the FIO from the responsible R&D command. The COEA proponent may also task TRASANA for assistance in projecting the COEA threat. The threat for nonmajor systems will be validated jointly by TRADOC and DARCOM Headquarters. In all cases the COEA preparing agency should assure that the threat includes current and projected hostile capabilities as well as a range of reasonable enemy responses to the conceptual system. It is of utmost importance that the threat document address the total threat to the total system, i.e., potential hostile countermeasures against the main system, its subsystems, components and supporting systems and organizations.

As a matter of policy the COEA proponent, along with representatives from the responsible R&D command, should meet with ITAC representatives to map threat strategy while the COEA plan is being developed. That well-defined threat should then be used as the basis for the initial conceptual definition of CCM and, later, for the design and refinement of the specific CCM devices and equipment used on the system. In the COEAs, CCM should be explicitly addressed in the analysis of operational concepts, specific functional objectives, system alternatives, system characteristics/performance/effectiveness and uncertainties; CCM should also receive ample consideration in the development of essential elements of analysis (EEA) and measures of effectiveness (MOE). Specific functions of the COEA proponent, the supporting analytical agency (normally TRASANA) and TRADOC staff elements are defined in TRADOC Reg 11-8. The COEA proponent should maintain close interaction with the responsible DARCOM R&D command regarding the technical characteristics, signatures and CCM for the developmental system and with INSCOM/ITAC for changes to the threat and for the technical characteristics of potential CM.

3.4 Threat Manager/Foreign Intelligence Officer

The primary responsibility of the TM related to COEA is the development and update of the threat to nonmajor systems (and certain major systems, as specified by INSCOM/ITAC). With the requirement for a COEA becomes known, the TM should contact ITAC for guidance and assistance regarding threat preparation and sources of previously validated information related to the system under consideration. The TM should also establish and maintain continuing contact with the FIO from the appropriate DARCOM R&D command who will

provide him with technical details of the current and projected threat to the system. The TM will develop the tactical, organizational and doctrinal aspects of the threat, but that portion should be prepared with full consideration of the technical aspects provided by the FIO. The TM and the FIO will attempt to identify all information gaps and will forward them to INSCOM/ITAC as Intelligence Production Requirements. In the event that INSCOM forecasts a lengthy delay before the required threat information can be provided, the TM and FIO should exercise their best judgment and expertise to produce logical and reasonable estimates of the threat. Those estimates will be identified clearly for higher headquarters (TRADOC and DARCOM) review and approval or modification. The estimates will then be modified or updated in a subsequent COEA as the needed information is made available by ITAC.

3.5 TRADOC Systems Analysis Activity

The preparation and content of the study plan which initiates a COEA, particularly the initial COEA, is of overriding importance. That plan, which will normally be prepared by TRASANA, will guide the level of effort and types of analyses required to determine logical and reasonable potential CM to the developmental system from which CCM will be derived.

Of particular interest in the CM/CCM context are the activities and responsibilities of the Special Studies Division of TRASANA. Its mission is as follows:

> Perform studies and analyses related to the survivability/vulnerability (S/V) of Army weapons systems and forces, countermeasures/counter-countermeasures (CM/CCM) on selected Army weapons systems and programs, and resources analysis (cost and force structure analysis) in support of COEAs and selected studies. The activities include the following principal elements: perform analysis as either "stand alone" analysis or as an integral portion of COEAs; perform studies to establish the effectiveness of S/V and CM/CCM concepts, tactics, or doctrine relative to design or employment; plan, develop and conduct resource analyses for providing cost and force analysis data and force design studies for the entire TRADOC community. (TRASANA Pam 10-1.)

3.6 TRADOC Test Activity/TECOM/OTEA

Prior to the conduct of the initial COEA, critical issues for test will have been identified to the test community by the proponent school/center. Critical CM and appropriate CCM will be included in the initial COEA. At that time, however, they will not have been tested; rather, a range of performance will be used based on experimentation and technical analysis. The results of DT/OT I will be used for the second COEA and DT/OT II for the third COEA. It is important that the test designers include testing of CCM in both the technical DT and tactical OT, the latter under conditions that closely approximate real battlefield conditions. For specific details of testing in relationship to COEA, see TRADOC Reg 71-9.

3.7 DARCOM CM/CCM Office

The DARCOM CM/CCM Office will review the technical portrayal of threat systems and equipment in the COEA for adequacy and accuracy. This office will also review the analyses of operational concepts, specific functional objectives, system alternatives, system characteristics/performance/effectiveness and uncertainties to assure an explicit address of CM and CCM in each analysis. If deficiencies are found, appropriate comments will be prepared and submitted to the TRADOC proponent for incorporation into the COEA and consideration by the decision body (DSARC, ASARC or IPR).

3.8 R&D Command/PM

The appropriate DARCOM R&D command or the PM, if appointed, will provide all relevant technical data needed for the COEA to the TRADOC proponent school/center or to the TSM, if appointed. That data should include technical descriptions, performance specifications, performance measurements and test/experimental results of candidate CCM. (It is recognized that the initial COEA for a given system will be done with only a limited amount of such technical data. When it becomes available, it will be used to update the original COEA.) The development of CCM will be based on the technical aspects of the threat provided previously by the FIO working in conjunction with the proponent TM (nonmajor systems) or by INSCOM/ITAC for major and designated nonmajor systems.

3.9 AMSAA

AMSAA will provide the proponent, through DARCOM channels, item level system performance estimates, which will include survivability/vulnerability data as well as the results of appropriate testing and experimentation on threats against the conceptual system. Much of the conceptual CCM effort will be based upon these analyses; consequently, selection of candidate CCM for the purpose of initial and subsequent COEA will be influenced by these inputs.

3.10 ITAC

ITAC is responsible for the preparation of threat documentation used for the COEA on major and designated nonmajor systems. That threat should include current and projected hostile capabilities, doctrine and techniques as well as the most likely hostile responses to the conceptual system. It should include all possible tactical and technical hostile countermeasures which have a high probability of use against the conceptual system, its components and subsystems and its supporting systems. For nonmajor systems and for those major systems for which threat preparation has been delegated to TRADOC and DARCOM, ITAC will provide guidance and assistance to the TM and the FIO (see paragraph 3.4). In addition, ITAC should be represented on the STF/SSG (for initial COEA) or COEA Review Board to assure that the threat to the developmental system is described adequately and given appropriate consideration.

4.0 DEVELOPMENT TESTING

Development testing (DT) is conducted to assist the engineering design and development process and to verify the attainment of technical performance specifications and objectives. It is accomplished in factory, laboratory and proving-ground environments using experienced and qualified civilians and military personnel. Normally, engineering design testing (EDT), advanced development verification testing (ADVT), prototype qualification testing (PQT) and production validation testing (PVT) will be included as part of DT. DT may also include a comparison between competitive items or systems. (See AR 70-10 and DA Pam 70-21 for further details.)

Development testing is required to be coordinated with operational testing, force development testing and any other testing that is planned for a particular developmental system. The process by which this is accomplished is here referred to as the TIWG process. It includes formally chartered Test Integration Working Groups (TIWGs), informal TIWGs, working-level TIWGs, telephonic or correspondence coordination, or any other process which produces a coordinated test program. DA Pam 70-21 describes the major participants in the TIWG process and contains a breakout of their roles.

This section of the handbook addresses the testing of CM/CCM issues during the complete DT process, beginning with the development of DT critical issues and independent evaluation plans and continuing through the detailed test planning, the conduct of testing, and the reporting and evaluation of the test results. All developing testing (DT I, DT II and, if scheduled, DT III) is included.

Since DT I is performed using prototype items, all CCM aspects of the system may not be testable at this stage. The design configuration of the system may well be incomplete, and it may not be physically possible to conduct testing using realistic CM or tactical scenarios; however, it should be possible to examine at least some technical CCM features of the equipment and to make determinations as to the areas requiring further testing during DT II.

DT II provides the final technical data for determining the system's readiness for transition into production; therefore, all CCM aspects of the system should be fully tested at this time.

DT III is normally conducted only if limited production or low-rate initial production is required. CCM testing during DT III should be limited to a verification that the performance demonstrated during DT II has not been degraded by the production process. DT III may also confirm that any problems disclosed during previous testing have been corrected.

4.1 TRADOC School/Center/TSM/TRASANA/TRADOC Test Activity

Although the TRADOC/combat development community has no direct role to play in DT, these organizations are able to influence DT through the TIWG process. Furthermore, the combat developer is frequently more attuned to the battlefield consequences of a failure to address CCM during system development than is the materiel developer. Accordingly, the combat developer should be particularly alert during the TIWG/pretest coordination process to review the extent to which the development tester plans to address CCM in a CM environment. These plans should be compared with the operational test (OT) plans, and there should be assurances that all CM/CCM issues for test are, in fact, tested. If this is not the case, then appropriate changes should be made to the DT, the OT or both.

4.2 TM/FIO

The TM and FIO should jointly prepare the threat test support packages in support of testing of nonmajor systems. This will ensure that DT and OT are conducted using the same, mutually agreed upon threat. (For major systems, the threat will be produced by INSCOM, unless this responsibility has been delegated to the combat and materiel developers; see paragraph 4.8.) Guidance for the preparation of the threat test support package may be found in AR 381-11 and TRADOC Reg 381-1.

The FIO will be the initial point of contact for all members of the DARCOM community needing threat information. He will coordinate the response to such requests within the intelligence/threat community. Similarly, the TM will be the initial point of contact for all members of the TRADOC community needing threat information and will coordinate the response to such requests within the intelligence/threat community.

In order to ensure that the threat documents are responsive to the needs of the test community and that the test community applies/uses the

threat correctly, the threat preparer or producer should be represented in the TIWG process. As a minimum, he should review the various test planning documents and make such recommendations to the preparer as necessary.

4.3 Special Task Force/Special Study Group

One of the functions of the STF/SSG is to make the initial identification of critical issues for testing such as those related to CM and CCM. (If an STF/SSG is not formed, these issues will be identified by the COEA study group, the materiel developer, the combat developer and/or the other participants in the TIWG process.) These issues will be apportioned, during the TIWG process, to DT, OT or a combination of both.

4.4 DARCOM CM/CCM Office

One of the functions of the DARCOM CM/CCM office is to ensure that adequate baseline data is obtained in test programs to permit assessing a system's CCM as part of its total evaluation. To this end, selected DT independent evaluation plans, coordinated test plans, and test and evaluation reports will be reviewed by this office. If adequate baseline data is not evident, appropriate comments or suggested changes will be submitted to the originator of the document.

4.5 Research and Development Command/PM (Materiel Developer)

The materiel developer has overall responsibility for the preparation and coordination of the Coordinated Test Program (CTP) and for management of DT. His specific responsibilities include chairing the TIWG (for major and designated nonmajor systems), preparing DT outline test plans, supervising contractor engineer design testing, and planning and arranging for the conduct of Government EDT. (The detailed planning and conduct of the other tests comprising DT are the responsibilities of the DT evaluator and tester, respectively.)

During the CTP preparation/DT planning process, the materiel developer must work very closely with the DT evaluator. He should ensure that the review described in paragraph 4.7 is accomplished, and he may work with the DT evaluator in conducting that review.

During the course of the DT planning process it may become apparent that some CM/CCM areas would be better addressed by OT or by a combination of

DT and OT than by DT alone. In that case, the TIWG process provides the opportunity to arrange such a distribution of responsibility.

As mentioned earlier, the TIWG for major and designated nonmajor systems is normally chaired by the materiel developer. In order to ensure that the best posssible threat information is provided to the TIWG, the TIWG chairman should invite the threat preparation agency to provide representation at appropriate TIWG meetings. When a TIWG is not formed, the various test planning documents should be coordinated with the designated threat preparation agency.

The materiel developer should monitor the conduct, reporting and evaluation of DT, both to ensure that the test is conducted as planned and that the test results are reported and presented fairly. He should also determine, as early as possible, if additional/changed CCM capabilities should be integrated into the system.

4.6 TECOM (DT Tester)

Note: For selected major and Category 1 nonmajor systems and for all Category 2 and below nonmajor systems, TECOM will also act as the DT evaluator. (For a discussion of that function see paragraph 4.7.)

The primary responsibility of the development tester is to perform the detailed planning, execution and reporting of the government portions of the advanced development verification test (part of DT I), the prototype qualification test (part of DT II) and the production validation test (if done as part of DT III). The independent evaluation plan and later the test design plan, both prepared by the DT evaluator, prescribe the items and issues to be tested; the detailed test plans, which the DT tester prepares, are based on these earlier plans. Thus the inclusion or deletion of an item (such as a CCM) from the test is a responsibility of the DT evaluator and not the tester. However, the DT tester is a participant in the TIWG/CTP coordination process and in the review and analysis of test data. Because of his background and experience, he may well be able to suggest to the DT evaluator areas to be tested/retested or methods of testing that would not otherwise be considered. This is particularly true in the CM and CCM areas.

4.7 AMSAA (DT Evaluator)

Note: AMSAA will normally act as the DT evaluator for major and Category 1 nonmajor systems. For Category 2 and below nonmajor system, Headquarters TECOM will act in this role.

The DT evaluator is responsible for preparing an independent evaluation plan, a test design plan and an independent evaluation report for each phase of DT. The IEP is the DT evaluator's internal master plan for acquiring data responsive to the decision process and provides the basis for formulating the test design plan. The TDP establishes the framework for the development of the detailed test plan by the DT tester. The IER evaluates system effectiveness in accordance with the standards set in the IEP.

During the DT planning process the DT evaluator must work very closely with the materiel developer (see paragraph 4.5). First the CCM requirements that are contained in the LOA, ROC, MENS, AP, development contract and similar program documents should be reviewed. Additionally, the critical issues as identified by the STF/SSG, the COEA study group, previous testing and previous IPRs, ASARCs or DSARCs should be reviewed and all CCM aspects noted. Secondly, the updated and validated/approved threat should be reviewed for CM aspects. (If necessary, the intelligence community should be tasked, through the FIO, to produce this updated threat.) An analysis of this threat will then be included in Section II of the test design plan. Thirdly, any existing DT directives, IEP, item level system performance estimates and/or TDP should be reviewed in the light of the first two steps. The goal of this review is to ensure that

a. A CM/CCM analysis, as described in Chapter III of this handbook, has been accomplished and the results of that analysis have been included in the system documentation.

b. All CCM aspects of the developmental system are fully addressed in the issues for test.

c. Sufficient testing or validated modeling is planned to answer all the issues for test and to cover the requirements and/or specifications stated in the (O)AP.

d. If deficiencies or gaps are found at any point, appropriate changes to the documents are recommended and/or accomplished.

During the course of the DT planning process it may become apparent that some CM/CCM areas would be better addressed by OT or by a combination of

DT and OT than by DT alone. In that case, the TIWG process provides the opportunity to arrange such a distribution of responsibility.

The DT evaluator should monitor the conduct, reporting and evaluation of DT, both to ensure that the tests are conducted as planned and that the test results are reported and presented fairly and clearly. He should also determine, as early as possible, if additional or changed CCM characteristics should be integrated into the system; if so, he should make appropriate recommendations to the materiel developer.

Following the DT, the test results must be analyzed, the IER must be prepared and the item level system performance estimates must be updated. The CM information contained within the developmental threat package will be an important factor in evaluating the realism and applicability of the test. This is also the time for the DT evaluator to determine any areas in which additional testing may be required.

4.8 ITAC

In response to the needs of the testing community for threat and/or countermeasure information, ITAC will produce a System Threat Assessment Report (STAR) for major systems. Guidance for the production of the STAR may be found in AR 381-11. DARCOM and TRADOC will jointly prepare the threat to nonmajor systems (and to major systems, when that responsibility has been delegated by INSCOM/ITAC) under the guidance and assistance of ITAC.

In order to ensure that the threat documents are responsive to the needs of the test community and that the test community applies the threat correctly, the threat preparer or producer should be represented in the TIWG process. As a minimum, he should review the various test planning documents and make such recommendations to the preparer as may be necessary.

4.9 OTEA

Although OTEA has no direct role to play in DT, it is able to influence the DT of major and selected nonmajor systems through the TIWG process. Furthermore, OTEA has extensive experience in conducting testing in realistic CM environments. Accordingly, OTEA should be particularly alert during the TIWG/pretest coordination process to review the extent to which the development tester plans to address CCM in a CM environment. These plans should be coordinated with the operational testing plans, and there should be assurances that all CM/CCM issues are, in fact, tested. If this is not the case, then appropriate changes should be made to the DT, the OT or both.

5.0 OPERATIONAL TESTING

Operational testing (OT) is conducted to assess a system's operational effectiveness, including vulnerability and operational suitability. It is conducted in as realistic an operational environment as possible and includes enemy countermeasures likely to be encountered.

Operational testing must be coordinated with development testing, force development testing and other testing that is planned for a particular developmental system. The Test Integration Working Group (TIWG) is the vehicle by which this is accomplished. Formal TIWGs must be chartered for major and Category I nonmajor systems; a similar coordination process is followed for other nonmajor systems, although it may be informal or conducted by telephone or correspondence. DA Pam 70-21 describes the major participants in the TIWG processs and contains a breakout of their roles.

This section of the handbook addresses the testing of CM/CCM issues throughout the complete OT process, beginning with the development of OT critical issues and independent evaluation plans and continuing through the detailed test planning, the conduct of testing, and the reporting and evaluation of test results. All operational testing (OT I, OT II and, if scheduled, OT III) is included.

It is recognized that all CCM aspects of the system may not be testable during OT I, since testing is done with prototype items. The design configuration of the system may be incomplete, and it may not be physically possible to conduct testing using realistic CM or tactical scenarios. However, it should be possible to examine at least some technical CCM features of the equipment and to make determinations as to specific areas requiring further investigation during OT II.

Since OT II normally provides the final data for determining the system's readiness for transition into production, all CCM aspects of the system should be fully tested by Milestone III.

OT III will only be conducted if low-rate initial production or limited production, plus the necessity for OT III, has been determined at Milestone III. CM/CCM testing during OT III (if scheduled) should be limited to a verification that the performance demonstrated during OT II has not been degraded by the

production process and to a confirmation that corrections have been made to problem areas disclosed during previous testing.

The responsibilities of the various players for the major events during OT are shown in Table VI.5.1

5.1 Proponent School/Center

For major and Category 1 nonmajor systems, the TRADOC proponent will provide input to OTEA for the development of the IEP and TDP. For Categories 2, 3 and 4 nonmajor systems, the IEP will normally be prepared by HQ TRADOC; however, the proponent may be tasked to provide input for this process or even to develop the entire plan. In either event, the steps that are followed are as follows: First, the LOA, ROC, AP, development contact and similar program documents must be reviewed. Additionally, the critical issues, as identified by the STF/SSG, the COEA study group, previous testing, previous IPRs, ASARCs or DSARC, and the DT independent evaluation plan should be reviewed and CM/CCM aspects noted. Secondly, the updated and validated/approved threat should be reviewed for CM aspects (if necessary, the intelligence community should be tasked, through the TM, to produce an updated threat). The responsible action officer is then ready to prepare the CM/CCM portions of the IEP. He must ensure that

a. A CM/CCM analysis, as described in Chapter III of this handbook, has been accomplished and the results of that analysis have been included in the system documentation.
b. Critical CCM aspects of the developmental system are fully addressed in the issues for test.
c. Sufficient testing or validated modeling is planned to answer all the issues for test and cover the requirements and/or specifications stated in the (O)AP.
d. If deficiencies or gaps are found at any point, appropriate changes to the documents are recommended and/or accomplished.

During the course of the OT planning process, it may become apparent that testing in a totally realistic CM environment may not be possible.

Event	Major and Category 1 Nonmajor Systems	Category 2 Nonmajor Systems	Category 3&4 Nonmajor Systems
Prepare IEP	OTEA	HQ TRADOC[1]	HQ TRADOC[1]
Approve IEP	N/A	N/A[1]	N/A[1]
Prepare TDP	OTEA	Test Activity	Test Activity
Approve TDP	N/A	OTEA	HQ TRADOC
Conduct Test/Prepare TR	OTEA	Test Activity	Test Activity
Prepare IER	OTEA	HQ TRADOC[2]	HQ TRADOC[2]
Approve IER	N/A	N/A[2]	N/A[2]

[1]Preparation of IEP may be delegated to the proponent; if so, IEP will be approved by HQ TRADOC.

[2]Preparation of IER may be delegated to the proponent; if so, IER will be approved by HQ TRADOC.

Table VI.5.1 RESPONSIBILITIES FOR MAJOR EVENTS DURING OT

Safety precautions, equipment or dollar limitations, jamming restrictions or other reasons may all constrain the use of full-play CM. Some of these shortfalls in the OT may be addressable through DT or through modeling or simulation; the TIWG/CTP coordination process provides an opportunity to arrange such alternate methods of addressing these areas. There may be areas, however, which it is simply not practical to address; in such cases, the limitations of the test and their consequences must be clearly spelled out in the IEP/IER for the consideration of the decision makers.

For Categories 2, 3 and 4 nonmajor systems, the TRADOC proponent must also review the test design plan, prepared by the test activity, before forwarding it to higher headquarters for approval. The TDP should be based on and faithfully carry out the intention of the IEP. The reviewer must ensure that this is the case; if not, the plan should be returned to the originator for correction.

The TRADOC proponent is also responsible for preparation of the doctrinal and organizational test support package for all categories of systems. The particular portions of this package of interest from a CM/CCM standpoint are

a. The means of employment include the doctrine, tactics and means of employment of CCM, especially tactical CCM.

b. The mission profile or operational mode summary includes both expected CM and the corresponding CCM.

c. The test setting shows the interaction among threat, friendly actions and the environment of the tested system. It must be compatible with the threat test support package which is provided by the threat community.

The proponent should monitor the conduct of testing to ensure that it is being conducted according to plan. Following the test, the proponent may be delegated the responsibility for preparation of the IER. If so, it should be based on the IEP and consider the results of all testing and other analyses done on the system to that point. It may also include recommendations for further testing that may be required.

5.2 TSM

As the primary TRADOC point of contact for this designated system, the TSM must task, monitor and/or direct the activities of all the other agencies involved. Further details may be found in Total System Management.

5.3 TRADOC Systems Analysis Activity

The test process complements and assists the cost and operational effectiveness analysis (COEA) process. Since the viability and worth of COEA are directly proportional to the validity of the input data used, TRASANA analysts must provide their data needs to the test organization prior to the preparation of the TDP. Additionally, COEA and other analyses often identify issues which should be answered or validated during testing. These issues should be included in the IEP.

5.4 TRADOC Test Activity

With respect to CM/CCM, the primary responsibility of the TRADOC test activity lies in the preparation of the test design plan. This is done by OTEA, with input from the test activity, for major and Category 1 nonmajor systems. The test activity has responsibility for the entire TDP for Categories 2, 3 and 4 nonmajor systems. The TDP is based on the critical issues contained in the IEP and/or (O)AP and describes the testing necessary to answer these issues. However, the TDP is not limited to those issues identified earlier; areas appropriate for testing, such as CM/CCM, will be addressed in the TDP regardless of whether or not they are in the IEP and/or the (O)AP.

The test activity, whether OTEA or a TRADOC unit, is then responsible for conducting and reporting the test in accordance with the test plans.

5.5 R&D Command/PM/TECOM/AMSAA

Although the DARCOM/materiel development community members have no direct role to play in OT or FDTE, they are able to influence these tests through the TIWG/CTP coordination process. Furthermore, the materiel developer is usually more attuned to the technical aspects of both CM and CCM than is the combat developer. Accordingly, the materiel developer should be particularly alert during the TIWG/CTP coordination process to review the extent and methods by which the operational tester plans to address these issues. These plans should be compared with the DT plans, and there should be assurances that all critical CM/CCM issues appropriate for test are, in fact, tested. If this is not the case, then appropriate changes should be made to the DT, the OT, the FDTE or all of them.

5.6 Operational Test and Evaluation Agency

OTEA plays several roles within the overall OT process:

a. Since OTEA is responsible for all OT in the Army, chairs the Test Schedule and Review Committee (TSARC), and publishes the Five-Year Test Program (FYTP), it is in a position to direct that CM/CCM considerations be included, as a matter of policy, in all OT. OTEA is also empowered to monitor compliance with such directives and to enforce them through the TSARC/FYTP.

b. For major and Category 1 nonmajor systems, OTEA is responsible for the preparation of the IEP and, after the testing is completed, the IER. The preparation of these documents follows the steps prescribed for the TRADOC proponent school/center to follow and described in section 5.1 above. OTEA may also obtain assistance and input in this effort from the TRADOC proponent. OTEA is also the designated test activity for OT of major and Category 1 non major systems. Here the functions performed are essentially the same as those of the TRADOC test activity with respect to Categories 2, 3 and 4 systems, described in section 5.4 above. OTEA may task a TRADOC test activity, such as TCATA, to assist in this effort; the responsibility, however, remains with OTEA.

c. For OT II of Category 2 nonmajor systems, OTEA prescribes the test objectives and the scope and tactical context of the test. These all have CM/CCM aspects. The tactical context is intended to be a realistic operational environment; it should include all enemy countermeasures normally expected to be encountered. The scope of the test and the specific test objectives should then include an examination of the operational effectiveness of the tactical and technical CCM included in or used with the system under test.

d. OTEA is responsible for granting formal approval to TDP developed within TRADOC for Category 2 nonmajor systems. Here OTEA should ensure that adequate consideration of CM/CCM has been included in the test design; if not, appropriate corrections should be directed.

e. OTEA will selectively monitor the OT of Category 3 and 4 systems. This monitorship may consist of a review of test documents, plans and reports, a visit to the test site to oversee the conduct of the test or any other steps that are felt necessary. During this review process, there should be assurance that realistic CM environments are used and that the operational effects of CCM (or their absence) are examined and reported.

6.0 OTHER TESTING

This section addresses certain testing (other than DT or OT) which may be performed in support of the materiel acquisition process. All such testing is coordinated through the TIWG/CTP process described in DA Pam 70-21. These tests include

a. Force Development Testing and Experimentation (FDTE).
   FDTE is conducted primarily to evaluate new concepts of tactics, doctrine and organization and may also address new items of materiel. It may be conducted at any phase of the development cycle. FDTE is divided into major tests, for which OTEA has primary responsibility, and nonmajor FDTE, for which TRADOC is responsible.

b. Initial Operational Capability - FDTE. This is conducted with the first production materiel and the IOC unit. TRADOC is normally the tester for all IOC-FDTE, including that for major and Category 1 nonmajor systems.

c. FDTE-OFT. This tests the operational feasibility of commercial, foreign or other service systems and may provide input to an LOA, ROC, LR, AP or PIP.

d. Concept Evaluation Program. Tests provide TRADOC school/center commanders a vehicle for small-scale, quick-reaction examinations of new concepts or new materiel systems; they may lead to further investigations or initiation of formalized development contracts.

e. Follow-on Evaluation. This is conducted subsequent to the full-production decision to provide information regarding unresolved operational issues.

None of these tests is a required part of the materiel acquisition process; the requirements for test documentation are somewhat less stringent than those for DT or OT and are determined on a case-by-case basis. The tests themselves are similarly limited and will normally address only the specific issues requested by the decision maker/body directing the test.

6.1 CAC/School/Center/TSM/TRASANA/Test Activity

All of these other tests, except for major FDTE, are handled within the TRADOC community. The plans and reports (IEP, TDP, DTP, TR, IER), if required, are normally developed in a similar manner to those for OTs of commensurate size (see the appropriate paragraphs of section 5). The handling of CM/CCM will vary according to the type and purpose of the test. An IOC-FDTE, for instance, may be conducted in a full CM environment although CCM may not be specifically addressed; a CEP test, on the other hand, may be conducted to examine one or more proposed CCM to a specific postulated Red CM. All participants in the testing process must be alert to and guard against the possibility that CM/CCM considerations will not be included when they should be.

6.2 Operational Test and Evaluation Agency

OTEA's role with respect to these other tests is essentially restricted to major FDTE, where it is similar to that for OT of major systems, i.e., prepare the IEP and IER as required. Since major FDTE will normally be conducted by TCATA or another TRADOC test activity acting for OTEA, that test agency will prepare the TDP and TR under OTEA's direction.

FDTE is normally conducted for a specific purpose, which may or may not include CM/CCM. During the preparation of the IEP, careful consideration should be given to this point, and the levels of CM and CCM to be employed should be clearly spelled out. The IEP should then be coordinated, through the TIWG, with the materiel and combat development communities and any nonconcurrences resolved.

OTEA may play a monitorship role, similar to that for OT of Category 3 nonmajor systems, for tests other than major FDTE (see section 5.6).

7.0 AQUISITION PLAN

An Acquisition Plan, formerly titled Development Plan, is a document of record, prepared by the materiel developer in coordination with the combat developer, which serves as the basic management document for a developmental system. Prior to Milestone II, while the system is being developed in response to a Letter of Agreement, the AP is in outline form (Outline Acquisition Plan). When the ROC/LR is approved, the OAP is expanded somewhat and becomes the AP. However, it should be kept in mind that the (O)AP is a living document and subject to continual updating as more and better information becomes available. General instructions for the preparation and coordination of an (O)AP are contained in AR 70-27 and the AMC-TRADOC Materiel Acquisition Handbook. The format of an (O)AP is summarized in Figure VI.7.1.

7.1 Proponent School/Center/TSM

The combat developer must work closely with the materiel developer in the preparation of the (O)AP. Each section will require input of some kind and must be coordinated by the materiel developer with the combat developer before it can be considered final. In particular, the combat developer must address the tactical CCM to be used with the system and the effects of operating the equipment in a countermeasures environment. This information must be included in the portions of the (O)AP described in section 7.3. The TSM will be the TRADOC focal point for ensuring that this coordination takes place.

7.2 TM/FIO

In responding to the needs of the materiel developer for input into the (O)AP, the FIO and TM will operate within the guidelines of AR 381-11. Within the materiel acquisition process, the FIO will be the initial point of contact for all members of the DARCOM community needing threat information. He will coordinate the response to such requests within the intelligence/threat community. Similarly, the TM will be the initial point of contact for all members of the TRADOC community needing threat information and will coordinate the response to such requests within the intelligence/threat community.

7.3 Research and Development Command/PM

The office responsible for the preparation of the (O)AP must ensure that CM/CCM considerations are included at several points:

Section I System (Concept) Summary

I Nature of the Program
II Background
III Management Issues
IV System/Program Alternatives
- A. Technical and Operational Characteristics
- B. Costs, Funding and Funding Effectiveness
- C. Schedules and Milestones
- D. Risks
- E. RAM, Safety, Durability, Transportability and Electronic Compatibility
- **F. Impact on Force Design and Quantities Required**
- F. **G.** Impact on the Environment
- G. **H.** Vulnerability to Enemy Counteraction
- H. **I.** ECCM Considerations

V Assessment of Program Alternatives with Recommendations
VI Cost, Schedule and Performance Thresholds
VII Test and Evaluation
VIII Logistical Support
IX Management Plan
X Revision
XI Security Classification Guidelines

Section II System (Concept) Requirements and Analyses

Section III Plans for System (Concept) Development
- (1) Technical Development Plan
- (2) Management Plan
- (3) Financial Plan
- (4) Facilities and Resources Plan
- **(5) Producibility Plan**
- **(6) Advance Procurement Plan**
- (5) **(7)** Threat Support Plan

Section IV Coordinated Test Program

Section V Plan for Personnel and Training Requirements

Section VI Plan for Logistic Support

Note: Items in **bold print** are in AP, but not in OAP; words in parentheses are in OAP but not in AP; otherwise the OAP and AP have the same format.

Figure VI.7.1 FORMAT OF (OUTLINE) ACQUISITION PLAN

a. Section I System (Concept) Summary

Paragraph I (Nature of the Program) should include a discussion of the threat. The FIO should be tasked to provide this information (see section 7.2).

Paragraph IV (System/Program Alternatives) contains several subparagraphs:

Subparagraph A (Technical and Operational Characteristics) should include the technical CCM which it is intended for the system to have. It should also include any tactical CCM which have been identified. This information should be obtained/extracted from the LOA (see section 1.0 of this handbook) or ROC/LR (section 9.0), as appropriate.

Subparagraph G (in OAP); H (in AP) (Vulnerability to Enemy Counteraction) may be derived from a combination of the information contained in Paragraphs I and IVA. This subparagraph in particular should be coordinated with the combat developer.

Subparagraph H (in OAP); I (in AP) (ECCM Considerations) is included if the system is susceptible to or will have a different concept of operation in an electronic warfare environment. Assistance in preparing this subparagraph may be obtained through the FIO from the USA Intelligence Center and School and/or from the USA Intelligence and Security Command.

b. Section III, Plans for System (Concept) Development, addresses several distinct plans:

The Technical Development Plan translates the system (concept) characteristics into system, subsystem and associated system characteristics. The CM and CCM discussions contained within the plan thus are based on and amplify/clarify the information in Section I. The Threat Support Plan lists the milestones for the identification of required threat input and for the provision of the threat itself. It provides for continuous threat interface

throughout the materiel life cycle, particularly at key project/system milestones. It is developed in coordination with the FIO and other appropriate members of the threat community (see section 7.2).

c. Section IV, Coordinated Test Program, contains a summary of the CTP and may simply consist of Chapter 1 of the CTP. Sections 4, 5 and 6 of this chapter discuss CM/CCM during the testing process.

The materiel developer must coordinate each section of the (O)AP with appropriate commands and agencies. From a CM/CCM standpoint, the most important of these are the combat developer and the threat developer.

7.4 ITAC

ITAC will provide threat information in support of major system acquisition plans according to the guidelines in AR 381-11. Normally, a separate threat document will not need to be prepared to support the (O)AP. Rather, the materiel developer will use the latest version of the System Threat Assessment Report and the threat documents prepared in support of the MENS, the LOA, the testing program and/or the DCP/APM.

8.0 DECISION POINTS (DSARC, ASARC, IPR)

In general, the Defense Systems Acquisition Review Council (DSARC), Army Systems Acquisition Review Council (ASARC) or In-Process Review (IPR) provides the vehicle for a review and determination of the status of a materiel system acquisition program. Through face-to-face discussions, they enable top managers to determine the best courses of action. The level of review comprises the primary difference among the DSARC, ASARC and IPR. A DSARC serves the SECDEF managers; an ASARC establishes Army positions for major systems in preparation for DSARC or addresses DA-designated major acquisition programs. An IPR provides the basis for decision making for nonmajor systems when appropriate decisions are required.

The Decision Coordinating Paper (DCP) and the Army Program Memorandum (APM) are acquisition management documents which support the decision making process throughout the acquisition cycle for major systems. The DCP serves programs of interest at the DOD level and is the principal discussion document at an ASARC/DSARC review; the APM is the decision coordinating document for major Army programs for which the Secretary of Army has final authority, i.e., for programs which are reviewed by an ASARC, but not by a DSARC. These documents are prepared for each decision point. For nonmajor systems, an updated (Outline) Acquisition Plan serves a similar purpose (see Section 7.0). The DCP/APM is begun well in advance of each milestone to ensure sufficient in-depth review and revision as required. In that the DCP/APM presents the rationale for starting, continuing, reorienting or stopping a program, CCM considerations become a critical element in this document.

ASARC/DSARC I (following the exploration of alternative system concepts) reviews the proposed development to confirm that it is in consonance with the LOA and OAP. Preliminary mission profiles and performance envelopes are defined, based upon sound and balanced military, technical and economic objectives. The primary objective of the review is to determine if this phase has been completed sufficiently to permit transition to the validation and demonstration phase. The APM/DCP preceding ASARC/DSARC I defines the operating and performance thresholds of the system and provides sufficient flexibility for appropriate trade-offs.

ASARC/DSARC II/Validation IPR (following the validation and demonstration phase) reviews the development to determine whether it is in consonance with the ROC and AP, satisfies a real military requirement and is affordable. The readiness of the development to enter full-scale development is determined at this point. For ASARC/DSARC II/Validation IPR the DCP/APM/AP also includes sufficient flexibility to support engineering development.

ASARC/DSARC III/Development Acceptance IPR (the production and deployment decision) develops the recommendation for entry into full-scale production (occasionally, on an exceptional basis, into low-rate initial production). The system is verified as still satisfying a valid military requirement and being threat responsive and cost worthy. An identification of any major variances from the development and production program is added to the APM/DCP considered at ASARC/DSARC III.

8.1 TRADOC CM/CCM Office

The TRADOC CM/CCM office is responsible for providing CM/CCM guidance to all TRADOC participants as required at each decision milestone. This will be done by reviewing the APM/DCP and/or the AP, as appropriate, to ensure that CM have been adequately addressed. In addition, the treatment of CCM, particularly tactical CCM, will be carefully reviewed to ensure that the system will be adequately protected against the known and postulated enemy CM. In the event that discrepancies are found, suggested changes and improvements will be submitted to the originator and/or the decision body for their consideration.

8.2 Proponent School/Center

For the ASARC/DSARC I, the proponent school/center determines the need and timeliness of the new system, analyzes its operational concepts and objectives in terms of tactics and/or doctrine, and determines system trade-offs through comparison with alternative systems and/or concepts. Critical questions and issues associated with operational suitability and effectiveness, in terms of CM and CCM, are addressed as much as possible at this time and the minimum acceptable capability level is determined.

Prior to an ASARC/DSARC II/Validation IPR, the school/center determines that system trade-offs have produced a proper balance between cost and performance, i.e., user CCM performance criteria have not been compromised

or the program operational objectives changed since completion of the exploration of alternative system concepts. The proponent also ascertains that action has been taken to reduce the system susceptibility to potential CM.

For the ASARC/DSARC III/Development Acceptance IPR, the school/center confirms through appropriate analysis that the system is compatible with the user's needs; it plans for any additional analysis, to include CM/CCM considerations, that will support the review and decision process. The proponent also assures that the operational testing has adequately addressed the system's operational effectiveness, including CM vulnerability and CCM effectiveness. In areas where the operational requirements were not proven by testing or performance or where shortfalls were determined, the system's acceptability to the user must be verified. The means to resolve critical operational issues and to update tactics and doctrine, as applicable, are determined.

8.3 TSM

Particularly at the milestone points the TSM should consult with the materiel developer. The TSM should ensure that the user's CCM requirements are fully understood by the materiel developer and that critical CM/CCM issues have been given the highest level of attention and addressed accurately and adequately in the APM/DCP or AP. If such is not the case, the materiel developer should be told of the deficiency and the requirement to correct it.

8.4 TM/FIO

For all DSARC/ASARC/IPR the FIO and TM, as the primary focal points for all threat matters in their respective organizations, ensure that continuous coordination takes place between themselves and ITAC concerning threat areas which impact on the system. The FIO and TM ensure that the threat receives the necessary consideration from the materiel and combat developers so that ITAC receives sufficient lead time for producing the appropriate threat documentation. Additionally, the materiel developer, through the FIO, provides ITAC and the TM with details of the U.S. system under development and advises of changes as they occur. The FIO also focuses attention on threat changes having the potential to significantly affect the system under development.

The TM and the FIO, acting for the combat and material developers, jointly prepare threat documentation for nonmajor systems which is appropriate to

the decision process and consistent with existing DA validated threat documentation. ITAC provides guidance and assistance to the TM and FIO in this effort.

8.5 TRASANA

For the DSARC/ASARC I, TRASANA determines the benefits and measures of effectiveness as required and determines the advantages and disadvantages of the various system alternatives.

For the DSARC/ASARC II/Validation IPR, TRASANA provides data from appropriate analyses (trade-offs and effectiveness) in order to confirm the need for the system in terms of the threat and evaluates system alternatives and potential benefits. The formal vulnerability analysis is updated and the results are provided to the decision body.

TRASANA, for the ASARC/DSARC III/Development Acceptance IPR, provides the results of new analyses to support the review and decision process. The concepts analyses in the areas of operational need and mission requirements are updated, as are the cost/benefit trade-off analyses. The quantity versus quality analysis is revalidated in terms of realistic missions and forces.

8.6 TRADOC Test Activity/TECOM/OTEA

In the preparation of the DCP/APM, these organizations assist in summarizing the technical and operational criteria for each planned test and the critical issues to be addressed by each test. The test environment should include realistic CM to the degree necessary to demonstrate the adequacy of the system's CCM capabilities.

8.7 STF/SSG

For DSARC/ASARC I, an STF or SSG normally performs the functions of the materiel developer prior to his assignment. Therefore, the STF/SSG will normally be responsible for preparation of the APM/DCP prior to assignment of a PM. Subsequently, an STF/SSG may be convened at any time to undertake any task that may require the concentration of special expertise for a short duration.

8.8 DARCOM CM/CCM Office

The DARCOM CM/CCM Office should review the APM/DCP and/or AP, as appropriate prior to each major decision point. This review is to ensure that CM have been adequately included in the threat portion of the paper and that an

appropriate level of CCM protection has been recommended for inclusion in the system. The use of simple CCM tactics such as deployment techniques, procedural measures, concealment and replacement should be evaluated and included if appropriate.

8.9 R&D Command/PM

The materiel developer initially prepares the APM/DCP which identifies the objectives, thresholds, conditions and issues for each decision and assesses the important factors that influence the decision. The materiel developer should not recommend any courses of action without close coordination with the entire materiel systems acquisition community. For example, technical decisions or recommendations concerning CCM-related specifications should be considered in terms of operational tactics and the threat. Effective coordination with the appropriate participants provides the best assurance of developing a system which is operationally responsive and effective. For example, specific survivability improvements should be coordinated with AMSAA and TRADOC prior to making APM/DCP recommendations.

At the DSARC/ASARC I, the R&D command or PM assures that the proposed development is in consonance with the LOA and (O)AP in the areas relating to CM/CCM. The system performance envelopes must be based upon sound and balanced military, technical and economic objectives. CM/CCM aspects should be included as prime considerations when system alternatives are presented. The R&D command/PM ensures that performance thresholds are considered during trade-off analyses and that the DT requirements address CCM capability from a technical perspective.

At the DSARC/ASARC II/Validation IPR, the R&D command or PM ensures that the system development is in consonance with CM/CCM criteria in the ROC and the AP. He confirms that the system trade-offs address CCM adequately and ensures that the approach presented in the DCP/APM will surface any CM or CCM problems. He schedules additional testing to further evaluate CCM performance, if so indicated by his review of the DT I test results. He confirms the updated vulnerability analysis and provides the decision body with the results of any appropriate hardening trade-off analyses. He ensures that all applicable CM/CCM issues are addressed in detail and provides the decision body with

proposed solutions to previously identified CM/CCM problems. Additionally, he reconfirms that the technical specifications of the system are tailored to its operational requirements.

During the DSARC/ASARC III/Development Acceptance IPR, the R&D command or PM confirms that DT/OT II has sufficiently tested the system's important CCM characteristics and resolved major development problems and critical operational issues. He ensures that the program continues to satisfy the original threat response goal and/or that major variances can be identified and resolved. He also confirms the system's acceptability to the user in any areas where performance deficiencies have been surfaced but not resolved.

8.10 AMSAA

AMSAA performs survivability analysis and provides guidance to the R&D designers, developers and program managers. AMSAA's approach involves families of systems rather than particular systems and concentrates in the areas of materiels, methods and techniques. All aspects of CM/CCM are, or should be, brought into play in the vulnerability reduction efforts. Continual close coordination between the materiel developer and AMSAA in the consideration of trade-offs and alternatives will ensure optimization of CCM.

8.11 ITAC

ITAC is responsible for the production of threat documents in support of major and designated nonmajor systems, unless this responsibility has been delegated to the combat and materiel developers (TM and FIO). In preparation for each major milestone (DSARC/ASARC), ITAC will update the MENS threat, the System Threat Assessment Report and the DCP threat statement and annex. (Further guidance may be found in AR 385-11.)

ITAC will also provide guidance and assistance to the TM and FIO when they are acting as threat preparers (see section 8.4).

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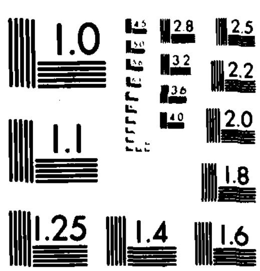

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9.0 REQUIRED OPERATIONAL CAPABILITY (ROC) LETTER REQUIREMENT (LR)

A ROC is a requirements document prepared by the combat developer, in coordination with the materiel developer and the threat community, which supports the full-scale engineering development phase of the RDT&E program. It is a concise statement of the minimum essential operational, technical, training, logistical and cost information necessary to initiate full-scale engineering development or procurement of a materiel system and is approved by HQDA. The format of a ROC is summarized in Figure VI.9.1. The ROC is a formal requirement and is normally not written until a thorough demonstration and validation program has been conducted or procurement of a nondevelopmental item has been determined to be desirable.

A Letter Requirement provides an abbreviated procedure used in lieu of a ROC for acquisition of low risk, low dollar value and/or commercial items. The format for an LR is summarized in Figure VI.9.2. The procedures for preparation and submittal of ROCs and LRs are essentially the same (they are covered in detail in AR 71-9 and the AMC - TRADOC Materiel Acquisition Handbook).

At this stage of system development, it is essential that all the developing agencies come to grips with all probable CM problems and their CCM solutions; the ROC or LR, when approved, will largely determine the configuration of the system which will be produced. All the preceding analyses and engineering efforts must now culminate in a system which will be as cost effective and survivable as possible when fielded.

The threat must continue to be updated and CM/CCM issues assessed even after DT/OT II. Unless, however, additional CM are identified which significantly or totally degrade the using force's capability to accomplish its mission, production will not normally be delayed; any newly identified CM will be addressed via a Product Improvement Proposal (see Chapter VII).

9.1 TRADOC CM/CCM Office

The TRADOC CM/CCM office will monitor all ROC related activities within the TRADOC community. This office will review the draft and final proposed ROC before their submission by the TSM to HQ TRADOC. The purpose of the review is to ensure that the ROC proponent has properly included CM and CCM

1. Statement Of The Need
    a. A descriptive title and brief statement of the requirement
    b. CARDS reference number
2. Time Frame
3. Threat/Operational Deficiency
4. Operational/Organizational Concept
5. Essential Characteristics
6. Technical Assessment
7. Logistic Assessment
    a. A baseline logistic support concept
    b. Potential logistic problem areas
    c. Preferred limits on the need for logistic support element resources
    d. Current and projected changes to pertinent supply, maintenance, and transportation systems and procedures
8. Training Assessment
9. Manpower/Force Structure Assessment
10. Life-Cycle Cost Assessment

Annex A Coordination
Annex B COEA
Annex C Rationale
Annex D RAM

Figure VI.9.1 FORMAT FOR REQUIRED OPERATIONAL CAPABILITY

considerations in the document, that is, that all reasonable CM have been included in the threat considerations and that appropriate CCM, either technical or tactical, have been included in the system. If a systematic procedure, such as that described in Chapter III, has been followed in developing the CM/CCM considerations, that is strong evidence that the process has been done correctly. If CM/CCM considerations have not been properly included, the CM/CCM Office will assist the proponent in improving the document.

9.2 Proponent School/Center

Upon being designated proponent for a requirements document the TRADOC school/center will normally convene and chair a joint working group (JWG) to develop the draft ROC/LR. (Depending on the complexity of the system, the ROC/LR may be drafted by the proponent through coordination with the materiel developer and INSCOM representative and then staffed for comment without ever using a JWG.)

The first action of JWG with respect to CM/CCM should be to review the CM/CCM analysis which (presumably) was performed earlier in the developmental cycle.

The analysis should be updated or supplemented as necessary; technical expertise may also be called into play to address problems beyond the scope of the JWG. (See Chapters III and IV and Appendix C of this handbook). In some cases it may be appropriate for the JWG to redo or even initiate this analysis.

Once the proponent/JWG is satisfied that the CM/CCM analysis is complete and correct, the results of that analysis must be included in the ROC or LR. In a ROC, the CM will be discussed in Paragraph 3, tactical CCM in Paragraph 4, and technical CCM in Paragraph 5 (and Paragraph 6, if significant technical effort will be required). In an LR, CM will be addressed in Paragraph 3, and CCM in Paragraph 5.

The annexes to the ROC or LR must also include CM/CCM considerations wherever appropriate. This is particularly true of the Rationale Annex which supports the essential characteristics section of the basic document. The results of the CM/CCM analysis and the relative importance of the system to the using force will normally be used as the rationale for any characteristic required to reduce vulnerability or as a CCM. The results of the CM/CCM assessment also

1. Title of the Item
2. Statement of the Need
a. A brief statement of the requirement
b. CARDS reference number
3. Justification
4. Basis of Issue
5. Principal Characteristics
6. Testing Required
7. Logistic Support Implications
8. Training Assessment
9. Manpower/Force Structure Assessment
10. Other Service of Allied Nation Interest
11. Life-Cycle Cost Assessment

Annex A Coordination
Annex B Cost Assessment
Annex C Rationale
Annex D RAM

Figure VI.9.2 FORMAT FOR LETTER REQUIREMENT

significantly impact the COEA annex and greatly influence the design alternatives which are pursued during development. The executive summary of the COEA must clearly identify the CM/CCM issues which impact the COEA. (Detailed discussion of a COEA is in section 3 of this chapter.)

9.3 TRADOC Systems Manager

The TSM, if one has been appointed, coordinates preparation of the ROC/LR by the proponent. He also submits the completed product to TRADOC for approval and subsequent forwarding to DA. The TSM must ensure that all CM/CCM assessments have been included in his time line and the results considered during preparation of the requirements document.

9.4 TRADOC Threat Manager

The TM will ensure that the current and projected threats are considered in the ROC and should normally be a participant in the JWG. He will be the primary point of contact for the TRADOC members of the JWG in obtaining the threat/CM information they need.

9.5 TRADOC Test Activity/TECOM/OTEA

The appropriate test activity should be available to clarify CM/CCM issues which were tested or which resulted from testing. This will normally only be required when controversial data appears in the test reports which could influence the development of the organizational and operational concept or the essential characteristics of the system.

9.6 DARCOM CM/CCM Office

The DARCOM CM/CCM office will review the draft and final proposed ROC to ensure that CM and CCM are addressed properly (see section 9.1). If not, appropriate suggestions for improvement will be submitted to the ROC proponent through the R&D command.

9.7 DARCOM R&D Command

The proponent R&D command works very closely with TRADOC in developing the ROC/LR. With regard to CM/CCM it actively assists TRADOC to translate the results of vulnerability assessments and modeling efforts into essential characteristics. It includes CCM requirements in its analyses of the technical effort required in terms of scope, technical approach and associated risk (paragraph 6 of the ROC).

The R&D command must look at the results of testing and susceptibility/vulnerability assessments in the context of how the potential CM can be countered. The technical approaches with the greatest benefit must be explained to the combat developer and appropriate statements included as essential characteristics. A very close working relationship must be established with the TRADOC proponent in order to ensure that the user and technical communities have a common understanding of the susceptibility/vulnerability assessment results, what potential CM may degrade the system, what CCM are viable in terms of tactics and technical possibilities, and what trade-offs are available for the decision makers.

9.8 Project Manager

If a PM has been appointed, he will be actively involved in all CM/CCM aspects of his system. As outlined in DARCOM Reg 11-16, the PM must focus his attention on reviews and briefings from which program decisions are likely to emanate. Accordingly, he may task supporting R&D commands to participate in susceptibility/vulnerability assessments or may choose to appoint a responsible party within the project management office.

In any event, the PM will need to monitor various assessments and activities to identify potential CM and CCM related to his system since this could significantly influence his assessment of risks, trade-off determinations and the related planning. When the project initiation baselines are updated, CM/CCM considerations should also be adjusted based on updated threat information and current assessments of realistic CCM. The threat, combat and materiel development communities may already have accomplished this prior to writing the ROC. If not, however, the PM should initiate such action either through his tasking authority or by a contractor to avoid serious problems at the next decision point. Any CM/CCM issues which are identified as critical issues must be resolved or planned for resolution by analyses and trade-off studies in order to reduce risks to an acceptable level.

Will this detract from the PM's mission of fielding a viable system within cost and time constraints? On the contrary, consideration of CM/CCM before and during the ROC process will help ensure that the system is usable when

fielded and that expensive and time consuming last-minute engineering changes due to threat changes are minimized.

9.9 Foreign Intelligence Officer

The FIO will actively support the appropriate R&D command in updating the various threats to the system and developing technical threat data for inclusion in the CM/CCM analysis preceding the ROC. Additionally, the FIO will provide the DARCOM interface with INSCOM and the TRADOC TM and is encouraged to participate in the JWG.

9.10 U.S. Army Materiel Systems Analysis Activity

Having participated in development testing and the independent evaluation of the system prior to the writing of the ROC, AMSAA is in a position to contribute significantly to the JWG. As the DARCOM lead activity for survivability and vulnerability assessments, AMSAA has a vested interest in ensuring that the threat has been updated and the testing designed and evaluated accordingly. The AMSAA tactical operations analysis will directly influence the ROC since the mission profiles stated in the ROC have a major impact on the system design. AMSAA can also assist the R&D community in selecting technically and operationally suitable approaches to CM/CCM problem areas.

9.11 ITAC

ITAC is a key member of the JWG; the ITAC representative must be able to assist the technical and tactical players in the ROC writing process in evaluating and interpreting the threat and the results of the susceptibility/vulnerability assessments.

It is particularly important that the threat be projected throughout the expected operational period of the system under development and that it include the enemy's probable reaction to the fielding and use of our system (reactive threat).

CHAPTER VII
PRODUCT IMPROVEMENT PROGRAM

The Department of Defense views product improvement as an alternative to new development and an important method of materiel acquisition. In fact, evolutionary development is emphasized as an alternative which must be considered in COEA for developing systems. This alternative offers substantial savings in resources and time and generally falls into one of two categories.

The first type PIP is a redesign of a standard item of materiel or a developmental effort which leads to a new item, i.e., a PIP which significantly changes the tactical or operational performance envelope of the system. An example of this might be a major tank modification such as the M60A3. This type PIP must be initiated against a new requirements document (AR 70-15, AR 71-9) and will require the same effort as any RDT&E system, including OT requirements. The method of considering CM/CCM for this type PIP is covered in the earlier sections of this handbook.

The second type PIP, which this chapter addresses, provides configuration changes or modifications to assure personnel safety, reduces production and/or logistics support costs, corrects proven deficiencies in performance/product quality and/or significantly simplifies/standardizes/increases compatibility with other systems without really making significant changes to the performance envelope of the system. Systems in which susceptibilities/vulnerabilities to CM are uncovered late in the development process might fall into this category. An example could be a system in which unwanted IR emissions are discovered during OT II. While these emissions may be significant, the intended methods of operation and employment are not affected and a complete redesign of the item would not be appropriate. A decision could be made to produce an initial quantity of the item to meet the most urgent need; a product improvement could then be developed to be added to all future systems, with a subsequent retrofit to the initial systems.
Another example of this type PIP arises when the hostile CM capabilities increase during the operational lifetime of our equipment. It may well be more cost effective to add new CCM to our equipment, through a product improvement, than to design and build a totally new system to meet the increased threat.

A PIP normally begins when a field user, research and development command or contractor has an idea for improvement or when a significant shortcoming in a system is discovered. The PIP originator informally coordinates the idea with the system proponent to secure agreement that the idea has merit. Depending on the status of the system (whether or not it has been transitioned), the proponent will be an R&D or readiness command. The originator must also secure informal agreement from the TRADOC proponent for the system.

At this point, the technical proponent (usually an R&D command) takes over, coordinating the idea and gathering data. It is very important at this stage to ensure that the intelligence community is brought in to provide threat data. The action officer within the technical proponent must ask himself, "What will this PIP do to the characteristics of the system? Will the signatures be changed significantly? Will the operating characteristics change? Could this make the system more vulnerable?" Essentially he will have to perform a CM/CCM analysis, as described in Chapter III. Since he probably will not be able to accomplish this alone, he will need to obtain TRADOC and INSCOM assistance. This orderly addressal of potential CM/CCM issues, although relatively ill-defined at this stage, is important because, as the PIP becomes better defined, it will be the basis for a vulnerability assessment if one is determined to be necessary. For this type PIP, the process will allow the proponent to determine if a vulnerability assessment is actually needed or if there are possible issues for further investigation which could later lead into one.

When significant issues surface early, resources may be saved by excluding ideas, methods or designs which could not technically hope to overcome the CM/CCM problems. When the answers are not that obvious, additional study will allow the designers to select better design alternatives by culling out possible problems or by rank ordering them with regard to CM/CCM issues.

The actual drafting of the PIP is the responsibility of the technical proponent. While this type PIP will seldom be significantly affected by CM/CCM issues, a CM/CCM analysis should still be accomplished and the TRADOC and INSCOM communities should be consulted in a manner similar to that during an LOA or ROC JWG. The technical proponent then must obtain final coordination before submitting the PIP for approval. A statement of consideration of the

impact this PIP will have on the improved system's performance relative to current and projected countermeasures (threats) must be included in the PIP. For those systems whose performance is determined to be affected by the threat, a copy of the PIP Package, detailed analysis and developer's proposed solution must be forwarded to the DARCOM CM/CCM office thirty days prior to the applicable DARCOM PIP review for review and coordination. Upon final coordination, when the cost is within the threshold established for DARCOM approval by AR 70-15, the PIP will be approved by the technical proponent and copies furnished to DA and DARCOM. For more costly PIPs, approval comes from HQ DA (DCSRDA). Care must be taken to assure that significant CM/CCM issues which have been identified are included in test planning and highlighted at IPR/decision points.

In summary, the PIP process is really a reflection of the normal acquisition process in a smaller scale and a compressed time frame. Major PIPs, which significantly alter the system's performance envelope, require a ROC/LR/LOA and thus follow AR 71-9 procedures. Other PIPs will follow AR 70-15 and will normally not be significantly affected by CM/CCM issues. (For a more detailed treatment of the PIP process itself, see AR 70-15.)

APPENDIX A
GLOSSARY

AAH Advanced Attack Helicopter

ACSI Assistant Chief of Staff for Intelligence

AD Advanced Development

ADVT Advanced Development (or Design) Verification Test

AMSAA U.S. Army Materiel Systems Analysis Activity

AP Acquisition Plan

A plan prepared prior to entry into the full-scale development phase of the materiel acquisition process for developmental programs or prior to the production and deployment phase for nondevelopmental programs. It is prepared by the materiel developer/mission assignee in coordination with the combat developer, logistician, developmental and operational testers and trainer. The AP constitutes a definitive plan for management of the program to accomplish the objective addressed in an approved materiel requirement document.

APM Army Program Memorandum

An acquisition recording document initiated by HQDA and reviewed by the ASARC in the management of programs deemed by the Army to be major and for which program approval authority rests with HQDA (i.e., neither a Decision Coordinating Paper nor a Defense Program Memorandum has been required).

ARM Antiradiation Missile

ARRADCOM U.S. Army Armament Research and Development Command

ASARC Army System Acquisition Review Council

HQDA will make decisions on major systems through the ASARC. The ASARC is composed of the VCSA (Chairman), ASA (RD&A), ASA (IL&FM), CG DARCOM CG TRADOC, DCSOPS, DCS RDA, DCSLOG, DCSPER, DUSA (OR), and DIR PA&E. Additional participants, as appropriate, may be designated by the chairman. The ASARC reviews major Army programs at specific milestones and prior to a DSARC review, if one is to be held. Special nonmilestone ASARC reviews may also be conducted, as required.

BRL	U.S. Army Ballistic Research Laboratory
BTA	Best Technical Approach
CAA	U.S. Army Concepts Analysis Agency
CAC	U.S. Army Combined Arms Center
CACDA	U.S. Army Combined Arms Combat Development Activity
CARDS	Catalog of Approved Requirement Documents
CBR	Chemical, Biological and Radiological (Warfare)

CCM Counter-Countermeasures

Friendly devices, techniques or actions taken to ensure the operational effectiveness and/or deny exploitation of friendly equipment despite countermeasure activity by the enemy.

CD Combat Developer

The agency or command responsible for the formulation of concepts, doctrine, organization and materiel objectives and requirements for the employment of U.S. Army forces in a theater of operations and for the control of civil disturbances. The combat developer formulates Army functional systems (logistics, personnel, administrative and others as designated) which impact directly on or extend into a theater of operations. The U.S. Army Training and Doctrine Command (TRADOC) is the Army's principal combat developer. As such, it will conduct the majority of the Army's combat development activities and will guide, coordinate, and integrate the total combat development effort of the Army in accordance with guidance and direction received from HQDA. The relationship between TRADOC and other major commands and agencies with which it must interface in carrying out its combat development responsibilities is contained in AR 10-41.

CDEC	U.S. Army Combat Developments Experimentation Command
CEP	Circular Error Probable

CFP Concept Formulation Package

The documentary evidence that the concept formulation effort has satisfied the concept formulation objectives. The package consists of a Trade-Off Determination (TOD), Trade-Off Analysis (TOA), Best Technical Approach (BTA) and Cost and Operational Effectiveness Analysis (COEA).

CM Countermeasures

Enemy devices, techniques and/or actions that have as their objective the reduction of the operational effectiveness of friendly equipment.

COEA Cost and Operational Effectiveness Analysis

A documented investigation of

- o The comparative effectiveness of alternative means of meeting a requirement for eliminating or reducing a force or mission deficiency.
- o The validity of the requirement in a scenario which has the approval of HQDA and HQ, TRADOC.
- o The cost of developing, producing, distributing and sustaining each alternative in the military environment for a time preceding the combat application.

COMINT Communications Intelligence

Collection (search, interception and direction finding) and processing (range estimation, transmitter/operator identification, signal analysis, traffic analysis, crypt analysis, decryption, study of plain test, fusion of these processes, and reporting) of foriegn communications passed by electromatic means.

COMMEL Communications-Electronics

Countermeasures

See CM

Counter-countermeasures

CSL U.S. Army Chemical Systems Laboratory

CTA Commander Table of Allowance

CTP Coordinated Test Program

C^3 Command Control and Communications

DA Department of the Army

DARCOM U.S. Army Material Development and Readiness Command

of contact for all aspects of system development and to coordinate the status of all events in the life-cycle system management model for a major system, a designated nonmajor system requiring HQDA IPR approval, or one or more other similar or related nonmajor systems selected for DASC management.

DCP Decision Coordinating Paper

A summary top-management document for the Secretary of Defense that presents the rationale for starting, continuing, reorienting, or stopping a major development program at each critical decision point. It identifies the issues in each decision and assesses the important factors, including threat, program plans, risks, full military and economic consequences, critical issues to be resolved by test and evaluation, acquisition strategy, costs and performance parameters that influence a decision.

DCSOPS Deputy Chief of Staff, Operations and Plans

DCSORI Deputy Chief of Staff for Operations, Readiness, and Intelligence

DCSRDA Deputy Chief of Staff for Research, Development and Acquisition

Designated Nonmajor Systems

Nonmajor systems specifically selected for approval by HQDA. A system may be selected because it is of special interest to OSD or the Congress, has been directed for study by HQDA, is of unique importance to the Army or involves potentially large life-cycle costs.

DF Direction Finding

DIA Defense Intellignece Agency

DOD Department of Defense

DP Development Plan

A plan prepared, as a follow-on to the ODP, prior to entry into the full-scale development phase of the materiel acquisition process for developmental programs or prior to the production and deployment phase for nondevelopmental programs. It is prepared by the materiel developer in coordination with the combat developer, logistician, developmental and operational testers and trainer. The DP constitutes a definitive plan for management of the program to accomplish the objective addressed in an approved materiel requirement document. Now called Acquisition Plan (AP).

DSARC Defense System Acquisition Review Council

A council within the Office, Secretary of Defense to advise the Deputy Secretary of Defense on the status and readiness of each major system

under development to advance to a subsequent phase in its life cycle. Members of the DSARC include the Under Secretary of Defense for Research and Engineering, the Assistant Secretary of Defense (Installations and Logistics), Assistant Secretary of Defense (Comptroller), the Assistant Secretary of Defense (Program Analysis and Evaluation) and, for programs within their areas of responsibility, the Assistant Secretary of Defense (Intelligence) and the Director Telecommunications and Command and Control Systems (DTACCS). Normally, the DSARC reviews the Service Secretary recommendations to

- Initiate validation,
- Initiate full-scale development,
- Initiate low-rate production, and
- Begin full production.

The SECDEF will decide whether a DSARC or revised DCP is required for procurement of long lead time materiel or for evaluation of low-rate initial production.

DT <u>Development Testing</u>

Testing of materiel systems which is conducted by the materiel developer utilizing the principle of a single integrated development test cycle to demonstrate that the design risks have been minimized, demonstrate that the engineering development process is complete, demonstrate that the system will meet specifications, and estimate the system's military utility when introduced. DT is accomplished in factory, laboratory and proving-ground environments.

DTP Detailed Test Plan

D&V <u>Demonstration and Validation Phase</u>

The second phase in the materiel life cycle. This phase consists of those steps that are necessary to resolve or minimize special logistic problems identified during the conceptual phase, verify preliminary design and engineering, accomplish necessary planning, fully analyze trade-off proposals and prepare contracts as required for full-scale development. The demonstration and validation phase may include the use of advanced development and operational tests. The validation process may be conducted by competitive or single contractors or by in-house laboratories.

ECM Electronic Countermeasures

ECCM Electronic Computer-countermeasures

ED Engineering Development

EDT Engineering Design Testing

EEA Essential Elements of Analysis

ELINT Electronics Intelligence

Technical and intelligence information derived from foriegn, non-communications (e.g. radar), electromagnetic radiations.

EM Electromagnetic

EMI Electromagnetic Interference

EMP Electromagnetic Pulse

EO Electro-optical

ERADCOM U.S. Army Electronics Research and Development Command

EWL U.S. Army Electronic Warfare Laboratory

FDTE Force Development Testing and Experimentation

Tests that range from a small, highly instrumented, high-resolution field experiment to a large, less instrumented, low resolution (but still a controlled scenario) field test. Data from these tests are evaluated largely by using subjective rather than analytical techniques. They are conducted to evaluate new concepts of tactics, doctrine and organization and new items of materiel.

FEBA Forward Edge of the Battle Area

FIO Foreign Intelligence Officer/Office

FSED Full-Scale Engineering Development Phase

The third phase in the materiel life cycle during which a system, including all items necessary for its support, is fully developed, engineered, fabricated, tested and initially type classified. Concurrently, nonmateriel aspects required to field an integrated system are refined and finalized.

FSTC U.S. Army Foreign Science and Technology Center

FYTP Five-Year Test Program

Hard Kill The eleminination or degradation, through physical damage or destruction, of an item's military effectiveness.

HDL U.S. Army Harry Diamond Laboratories

HEL U.S. Army Human Engineering Laboratory

HQDA Headquarters, U.S. Department of the Army

IE Independent Evaluation

For DT, the process by which the materiel developer examines development test data and test reports; extrapolates from other evidence, including experimental and analytical data; and uses engineering judgment to assess and evaluate the capabilities of the tested materiel systsem, including RAM.

For OT, the process independent of the materiel developer and the using command which is used to examine the test design and test report; to extrapolate from other evidence, including experimental, historical and analytical data; and to provide military judgment to assess or estimate the military utility and operational effectiveness of the tested system, including RAM. For OT, IE concentrates on the operational aspects of the materiel system and considers other programmed testing and comments on operational tests provided by participants in the materiel acquisition process. Both independent evaluations assess the adequacy of testing and the validity of test results.

IEP Independent Evaluation Plan

IER Independent Evaluation Report

INSCOM U.S. Army Intelligence and Security Command

Intelligence

The product resulting from the collection, evaluation, analysis, integration and interpretation of all information concerning one or more aspects of foreign countries or areas, which is immediately or potentially significant to the development and execution of plans, policies and operations.

Intelligence Estimate

An appraisal of the elements of intelligence relating to a specific situation or condition with a view to determining the courses of action open to a potential enemy and the probable order of their adoption.

IOC Initial Operational Capability

The first attainment of the capability by a troop unit to employ effectively a production item or system provided

- The unit personnel have been trained to use and employ the item or system,
- The unit can be adequately supported in the field in such areas as logistics, documentation and training, and
- A favorable decision has been made on the suitability of the item or system for entry into the inventory for other than test purposes.

IPR (1) In-Process Review

During the life cycle of nonmajor programs, in-process reviews will be held to review project status and recommend a course of action. Their purpose is to provide recommendations, with supporting rationale, as a basis for system concept, system development, type classification and production decisions by the appropriate level of authority. They are intended to be forums where agencies responsible can present their views and ensure that they are considered during development, test, evaluation and production.

(2) Intelligence Production Requirement (DD form 1497)

Often called Foreign Intelligence Production Requirement (FIPR) in DARCOM to avoid confusion with In-Process Review.

IR Infrared

ITAC Intelligence and Threat Analysis Center, INSCOM

JWG Joint Working Group

A group consisting of members of different commands, such as TRADOC and DARCOM, established to accomplish a specific task such as preparation of a draft requirements document.

LOA Letter of Agreement

The LOA is a jointly prepared and authenticated document in which the combat developer and the materiel developer outline the basic agreements for further investigation of a potential materiel system. The purpose of the LOA is to ensure agreement between the combat and materiel developers on the general nature and characteristics of the proposed system and the investigations needed to develop and validate the system concept, to define the associated operational, technical and logistical support concepts, and to promote synchronous interaction between the combat developer and materiel developer during the conduct of these investigations. For LOA, DCSOPS, in coordination with OTEA, will identify and designate the organization to conduct operational testing.

LR Letter Requirement

The LR is an abbreviated procedure for acquisition of low-value items and may be used in lieu of the ROC when applicable. Low-value items are low-unit cost, low-risk developmental or nondevelopmental items for which the

total RDT&E expenditure will not exceed $1 million and/or the procurement costs will not exceed $2 million for any fiscal year or $10 million for the five-year program period. The LR is not appropriate for system components. The LR is jointly prepared and authenticated by the combat developer and materiel developer.

MAA Mission Area Analysis

Mission Area Analysis is an evaluation of a specific mission area in order to identify deficiencies in doctrine, organization and materiel; recommend preferred, feasible solutions to eliminate the deficiencies; and identify opportunities for capitalizing on technological breakthroughs. Primary inputs to an MAA include field experience and pertinent studies and analyses, including war games, computer simulations and tests.

MACOM Major Army Command

A command directly subordinate to, established by authority of, and specifically designated by HQDA.

Major Systems

Systems which qualify for DSARC decision and others which are critically important to the Army, complicated, expensive, controversial, or for any other reason should involve the top management of the Army. The designation of Army major systems considers

- OSD designation of DCP/DSARC systems,
- Significance of the added operational capability,
- The level of interest already expressed or anticipated (Congressional, OSD, SA or CSA),
- Overall resource impact,
- Relationships to other programs and materiel developers,
- Requirements for cooperation with other DOD components and allied Governments, and
- Development risks and system complexity.

Major System Acquisition

A system acquisition program designated by the Secretary of Defense to be of such importance and priority as to require special management attention.

MD <u>Materiel Developer</u>

The agency responsible for research, development, development testing and production validation of an item (to include the system for its logistic support) which responds to DA objectives and requirements.

MENS <u>Mission Element Need Statement</u>

A statement prepared by a DOD component to identify and support the need for a new or improved mission capability. The mission need may be the result of a projected deficiency or obsolesence in existing systems, a technological opportunity or an opportunity to reduce operating cost. The MENS is submitted to the Secretary of Defense for a Milestone 0 decision.

MERADCOM U.S. Army Mobility Equipment Research and Development Command

MIA U.S. Army Missile Intelligence Agency

<u>Mission Area</u>

A segment of the defense mission as established by the Secretary of Defense.

MOE Measures of Effectiveness

MTOE Modified Table of Organization and Equipment

<u>Non-major Systems</u>

Those systems which do not meet the criteria for designation as major systems in accordance with AR 1000-1.

NVEOL U.S. Army Night Vision Electro-Optics Laboratory

NWE Nuclear Weapons Effects

OAP <u>Outline Acquisition Plan</u>

Late in the concept phase the materiel developer, in coordination with the combat developer, uses the final report of the STF or the SSG as a basis for preparing the Outline Acquisition Plan (OAP). This document contains the materiel system concepts agreed upon by the materiel and combat developers. It also contains the CFP and the CTP, as well as a broad general plan for logistic support. In addition, the OAP provides a plan for the management of the research, development, testing and evaluation efforts which must be done to achieve the materiel objectives addressed by the LOA.

OSCA Office of the Chief of Staff of the Army

ODP Outline Development Plan

Now called Outline Acquisition Plan (OAP).

ODUSA **(OR)** Office of the Deputy Under Secretary of the Army (Operations Research)

OMEW Office of the Missile Electronic Warfare - a subordinate activity of EWL

Operational Tester

That command or agency responsible for the conduct of operational testing of items/systems. It derives program and budget information for OT, writes the OT portion of the coordinated test program, determines when, where, how and by whom OT will be accomplished, prepares operational test design plans, conducts or directs the conduct of OT, reports on test results and provides independent evaluations.

OPSEC Operations Security

OSD Office of the Secretary of Defense

OT Operational Testing

Testing and evaluation of materiel systems which is accomplished with typical user operators, crews or units in as realistic an operational environment as possible to provide data to estimate

- The military utility, operational effectiveness, and operational suitability (including compatibility, interoperability, safety, reliability, availability and maintainability, supportability, operational man (soldier)-machine interface, and training requirements) of new systems.
- From the user viewpoint, the system's desirability, considering systems already available, and the operational benefits/burdens associated with the new system.
- The need for modification to the system.
- The adequacy of doctrine, organization, operating techniques, tactics and training for employment of the system, the adequacy of logistic support for the system and, when appropriate, its performance in a countermeasures environment.

OTD	Office of the Test Director for Joint Services Electro-Optical Guided Weapon Countermeasures Test Program
OTEA	U.S. Army Operational Test and Evaluation Agency
OWL/D	Optical Warning Location Detection System
PGM	Program Guidance Memorandum/Precision-Guided Munition
PHOTINT	Photographic Intelligence
PIP	Product Improvement Program/Plan/Proposal
PK	Probability of Kill
PM	Program/Project/Product Manager
PQT	Prototype Qualification Testing
PVT	Production Validation Testing

P&D Production and Deployment Phase

The fourth phase of the materiel life cycle. During this phase, operational units are trained, equipment is procured to meet the authorized acquisition objective (AAO) and is distributed in accordance with major items distribution plan (MIDP) and logistical support is provided. Product improvements are applied to the equipment and/or support system when they are required by operational experience or employ new technology and doctrine. A table of organization and equipment (TOE), table of distribution of allowance (TDA) and common table of allowance (CTA) are refined or modified as required.

RAM	Reliability, Availability and Maintainability
RDT&E	Research, Development, Test and Evaluation
RF	Radio Frequency
ROC	Required Operational Capability
RPV	Remotely Piloted Vehicle
R&D	Research and Development

SAG Study Advisory Group

An advisory group formed by a study sponsor and composed of representatives from ODUSA (OR), OCSA, Army Staff Agencies and MACOMs having a clear functional interest in the study topic or use of study results.

SCORES	Scenario Oriented Recurring Evaluation System
SECDEF	Secretary of Defense
SEMI	Special Electromagnetic Interference

Signature

The characteristic pattern of a target displayed by detection and identification equipment; the visible effects such as smoke, flame or debris produced at the firing position when a weapon is fired; the characteristics of an item or unit which enable it to be detected, identified, located, etc.

SIGINT Signals Intelligence

A category of intelligence information comprising all communications (COMINT), electronics (ELINT), and telemetry intelligence.

SIGSEC Signal Security

SINCGARS Single Channel Ground/Air Radio System

S/N Signal to Noise

Soft Kill

The temporary degradation of an item's military effectiveness; frequently caused by electronic countermeasures.

SOTAS Stand-Off Target Acquisition System

SPIDERCHARTS Systematic Planning for the Integration of Defense Engineering and Research

A method of graphically displaying data showing the logical and sequential relationship between how the Army fights on the battlefield and the supporting DARCOM technological effort. The technique is widely used to provide visibility for various Army and DOD RDT&E programs.

SSG Special Study Group

A group, normally composed of representatives of HQDA, the combat developer, operational tester, materiel developer, logistician, trainer and the project manager designee, which is convened to conduct analysis, ensure inclusion of all alternatives within an analysis, monitor experimentation, or undertake other such tasks that may require the concentration of special expertise for a short time.

STANO Surveillance Target Acquisition and Night Observation Devices

STAR System Threat Assessment Reports

One of the basic documents outlining the threat to a materiel system. See AR 381-11.

STARTLE Surveillance and Target Acquisition Radar for Tank Location and Engagement

STF Special Task Force

A group that is normally composed of the chartered task force director and representatives of the user, materiel developer, trainer, combat developer, HQDA, operational tester and the project manager designee. This task force conducts an in-depth investigation of the need for the system described in the requirements documents and of any necessary alternative system designs, monitors experimentation, and arrives at a recommended approach to provide the system described in an approved ROC document.

STO Science and Technology Objective

STOG Science and Technology Objectives Guide

Susceptibility

The degree to which the device, equipment or weapon system is open to effective attack due to one or more inherent weaknesses.

TACFIRE Tactical Fire Direction System

TCATA TRADOC Combined Arms Test Activity

TDA Table of Distribution and Allowance

TDP Technical Data Package/Test Design Plan

Technical Vulnerability

The vulnerability of each component item of a system and thus of the system as a whole when countered in a tactically realistic manner with each of the expected countermeasures taken one at a time.

TECOM U.S. Army Test and Evaluation Command

Threat Analysis

The process of employing analytic techniques for developing plausible alternative representations of foreign environments and capabilities. Threat analysis

- Provides an assessment of foreign capabilities in terms of combat materiel employment doctrine, environment and force structure.
- Provides an assessment of the level of development which the economy, the technology and the military forces of a country have attained or could attain.
- Supports U.S. planning or development by extending in time and scope or by supplementing in detail available intelligence.

- Includes recasting existing intelligence assessments and forecasts to provide a statement of the threat as it relates to a specific U.S. combat or materiel development project.
- Fills gaps where data is not available or is too inconclusive to permit an intelligence estimate.
- Includes counterintelligence analysis of the multidiscipline (SIGINT, EW, PHOTINT and HUMINT) threat to Army forces posed by foreign hostile intelligence services.

Threat Analysis Operations

A general term used to describe activities associated with the development of threat products. It includes activities such as defining requirements, assembling or researching materials, applying threat analysis methodology, generating data, formatting data for specific needs, applying threat data in particular projects and preparing threat annexes/appendices.

Threat Evaluation

Normally, a reference to the Defense Intelligence Agency's evaluation of service-produced threat documentation. Such an evaluation stresses appropriateness and completeness of the intelligence, reasonableness of the judgments, consistency with existing intelligence positions, logic of extrapolations from existing intelligence and suitability of the methodologies employed.

TIWG	Test Integration Working Group
TM	Threat Manager/Technical Manual
TOA	Trade-Off Analysis
TOD	Trade-Off Determination
TOS	Tactical Operational System
TRADOC	U.S. Army Training and Doctrine Command
TRASANA	U.S. Army TRADOC Systems Analysis Activity
TSM	TRADOC System Manager/Total System Management
USALOGC	U. S. Army Logistics Center

Validated

Approved, sanctioned, officially ratified, or indorsed as to content and intent.

Vulnerability

The characteristic of a system which causes it to suffer a definite degradation (incapacity to perform the designated mission) as a result of having been subjected to a certain level of effects in an unnatural (man-made) hostile environment.

APPENDIX B
ANALYSIS EXAMPLE

This appendix contains an example of the CM/CCM analysis methodology actually in use by the Project Manager, Aircraft Survivability Equipment (PM ASE). It is adapted from a classified paper, Establishing Aircraft Survivability Equipment Requirements for Army Aircraft (U), jointly written by S. P. Smith (PM ASE), CPT T.E. Hanlon (USAAVNS) and D.M. Schott (Calspan Corporation). The paper was prepared under the auspices of the Permanent Steering Group for Aircraft Survivability Equipment (ASE). Additional details may be obtained, if desired, from Commander, U.S. Army Aviation Research and Development Command, Attn: PM ASE.

The steps of the process described in this paper do not bear the same titles as those used in Chapter III of this handbook. However, an examination shows that the events of the two processes are almost the same. Specifically, Blocks 1 and 2 (Aircraft and Mission Description and Threat Operational Situations) are functionally equivalent to the first two steps described in Chapter III (Obtain System Description and Identify Critical Components, Signatures and Countermeasures). Block III (Candidate ASE) corresponds to the fifth step (CM/CCM Alternatives). Block IV (Survivability Assessment) is equivalent to a combination of the third and fourth steps described in Chapter III (Technical Vulnerability and Battlefield Analysis); the remainder of the material in Block 4 (Penalty and Cost Assessments) is not really applicable to systems being analyzed very early in their life cycles. Blocks 5 and 6 (Trade-Off Data and Assessment) are functionally equivalent to the steps labeled Analysis of Alternatives and Decision Process in Chapter III. Blocks 7 and 8 (ASE System and System Characteristics) are merely a general and specific description of the CCM features selected for development. Thus, we see that the two analysis processes are essentially the same.

It should be noted, however, that while this example analysis considers several types of antiaircraft weapons rather thoroughly, it does not view the totality of CM and CCM discussed elsewhere in this handbook; e.g., the vulnerabilities of the communications and navigation systems are not included, nor are CBR, EMP and NWE. It should also be noted that the definitions of terms that are used in this appendix may be different from those used in the body of the handbook; the terminology used in the appendix is explained beginning on page 156.

OVERALL METHODOLOGY

The process of establishing aircraft survivabiblity equipment (ASE) requirements consists of choosing the best ASE system from a wide range of potential equipments to meet the operational needs for each mission of each aircraft. In addition, the specific requirements for each equipment in the ASE system must be determined so that the overall ASE system for a given aircraft achieves effectiveness, reliability, maintainability and logistics support goals for each aircraft within the constraints of an acceptable aircraft penalty and reasonable acquisition and support costs. Figure B.1 depicts the systematic approach used by the ASE PSG for performing requirements analysis for ASE. The approach consists of a series of interrelated computer aided analyses progressing from inputs (Blocks 1, 2 and 3) through analysis, trade-off and assessment (Blocks 4, 5 and 6), resulting in the required output (Blocks 7 and 8). Aircraft mission profiles (Block 1) are combined with threat intelligence data and air defense target arrays to provide detailed operational situations (Block 2) which form the basis for the survivability analysis. The mission profiles also establish the aircraft mission performance parameters (endurance, altitude, speed, configuration, ordnance, etc.), which are utilized in the penalty assessment to determine the impact of ASE penalties on each aircraft mission. Each candidate ASE (Block 3) and all appropriate combinations of ASE are evaluated in Block 4 to determine the survivability benefit provided the aircraft, the performance penalty to the aircraft and the unit cost of the ASE. In Block 5 (trade-off) the penalty effectiveness and cost effectiveness are evaluated and the most penalty-effective and cost-effective combinations of ASE identified. Blocks 4 and 5 are iterated over each aircraft mission, theater and set of threat assumptions to derive trade-off data for each case. The results of the trade-offs are evaluated further in the assessment step (Block 6) where additional decision factors are considered: development risk, operational uncertainty, operational suitability, availability dates, threat growth, priorities on theaters of operation, special mission requirements/constraints, mission frequencies, overall penalty and cost constraints, RAM requirements, maintenance factors, personnel, training and logistics considerations. The output of the assessment step is the systematic identification of the ASE system for each aircraft and the equipment characteristics for that system.

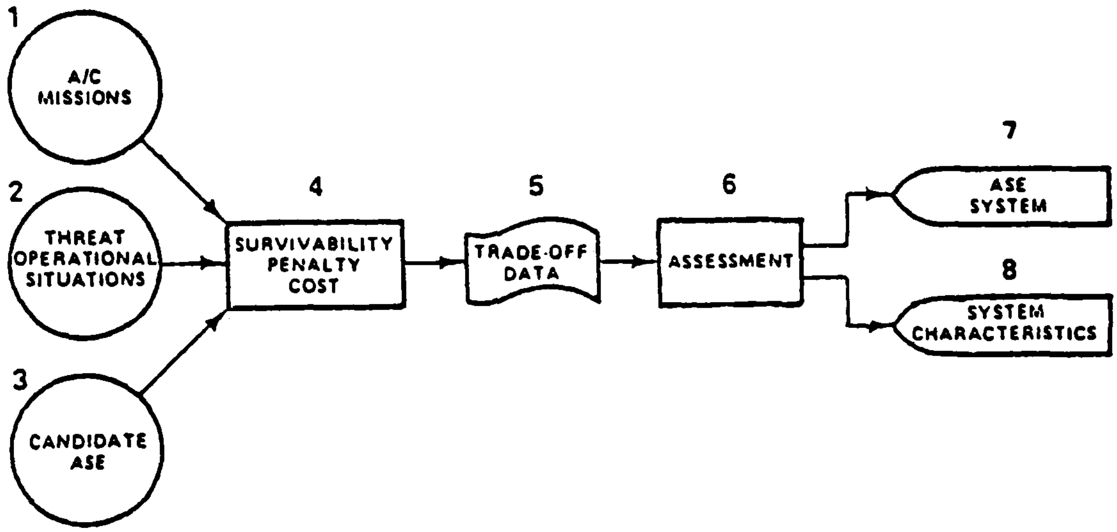

Figure B.1 REQUIREMENTS ANALYSIS

The underlying principle of the methodology in Figure B.1 is that the determination of critical trade-off parameters for each ASE (and combinations of ASE) is made using a common denominator. That is, the effectiveness, penalty and cost characteristics are determined using a common methodology for every ASE. Effectiveness, for example, is evaluated for each ASE in terms of the percentage reduction in aircraft attrition provided by each ASE over the aircraft without ASE. With this measure of effectiveness, the reduction in aircraft attrition afforded by a radar jammer can be directly compared to the reduction in attrition afforded by a particular vulnerability reduction feature (as opposed to comparing induced radar tracking error against reduced aircraft vulnerability, for example).

AIRCRAFT AND MISSION DESCRIPTORS (Block 1)

The aviation arm of the U.S. Army consists of a variety of aircraft that may be called upon to operate in combat situations (Figure B.2). As seen in the figure, these vehicles include observation, utility, attack and medium lift helicopters and fixed-wing intelligence and reconnaissance aircraft. Each aircraft type has multiple mission roles having different objectives and creating different threat encounter situations. Because the effectiveness and penalty of ASE are specific for each aircraft mission, descriptors used to characterize the aircraft must account for this factor. Also, the technological sophistication of ASE and threat systems requires a detailed description of the vehicles and missions so that the aircraft, mission, threat and ASE interactions can be properly represented.

Vehicle descriptors considered in establishing ASE requirements included

- Infrared signature,
- Visual/optical signature,
- Radar cross section,
- Vulnerability data,
- Air frame performance data, and
- Engine performance data.

The first four descriptors are needed to estimate the survivability of the baseline aircraft against the threat systems and the last two are used in the evaluation of baseline aircraft performance.

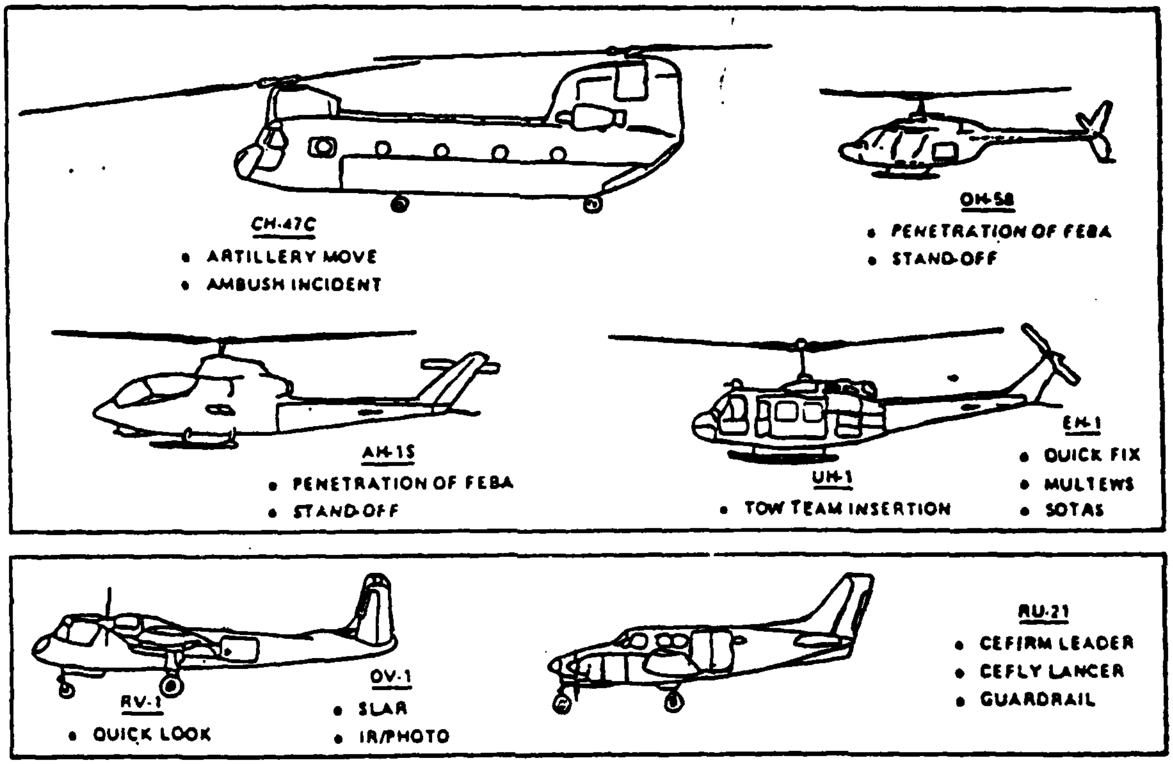

Figure B.2 AIRCRAFT MISSIONS EVALUATED

In practice, each descriptor encompasses numerous aircraft, mission, threat, ASE and operational environment variables. Each of these must be identified and the relationships understood to determine the level of detail needed for each vehicle descriptor above.

As an example, consider the IR description of the aircraft. Such a description is necessary because of the threat of surface-to-air and air-to-air IR missiles. The ability of these missiles to acquire and home on the aircraft is a function of environmental parameters, the aircraft/missile geometry, the aircraft configuration and operating conditions and the threat missile seeker characteristics. The detail required to specify IR signature dependencies is further illustrated by the following parameter listing:

- Environmental parameters
  - * Meteorological
    - Air temperature
    - Relative humidity
    - Pressure
    - Visual range
    - Cloud cover, type, height
    - Wind
  - * Sun position
  - * Ground cover, temperature, emissivity
- Aircraft/missile geometry
  - * Aircraft roll, pitch, yaw
  - * Aircraft/missile line-of-sight geometry
  - * Range
  - * Background
- Aircraft configuration/operation
  - * With or without IRCM
  - * Gross weight
  - * Velocity
  - * Aircraft paint
  - * Engine operating conditions
- Threat seeker characteristics

* Field of view
* Sensitivity
* Reticle type
* Resolution

Similar detail is needed for the other vehicle descriptors, not only to provide a good estimate of the baseline aircraft survivability, but also to provide a means for properly introducing and representing ASE effects against the threat systems and on aircraft performance.

Mission selection and description require a joint user/developer effort to identify high frequency or special situations which represent a realistic set of missions for consideration from an ASE point of view. The mission descriptions provide objectives, planned routes, tactics and performance constraints for each aircraft mission combination selected. With the participation of user representatives these mission descriptors can be quantified in terms of parameters of relationships compatible with existing analytic tools or those developed for the ASE requirements study. Mission descriptors include

- Mission objective,
- General description of mission,
- Definition of a measure of mission effectiveness,
- General tactical situation (enemy forces/friendly forces),
- Expected meterological conditions--temperature, visibility, cloud cover, etc.,
- Flight profile (speed, altitude, time/distance for each leg),
- Takeoff gross weight,
- Fuel load,
- Weapons configuration,
- Ordnance and stores,
- Tactics at target/objective,
- Firing doctrine at target/objective,
- Air defense suppression being conducted (other than onboard ASE),
- Number of aircraft in flight,
- Mission related maneuver restrictions (e.g., straight and level flight for mapping missions),

- Expected intelligence on air defense site locations and accuracy of the information,
- Doctrine regarding targets of opportunity and unanticipated air defense concentrations, and
- Tactical response to hostile airborne intercept, receipt of ground fire, etc.

THREAT OPERATIONAL SITUATIONS (Block 2)

A common scenario was needed for the survivability assessment to represent basic operational situations for each aircraft. This common scenario was provided through the Combined Arms Combat Development Agency by the Scenario Oriented Recurring Evaluation System (SCORES). SCORES scenarios document a consistent set of operational plans, intelligence summaries, threat force organizations and equipments and general threat laydowns. Within this general situation, special incidents are defined and gamed as part of the SCORES evaluation process. Several of the special incidents were selected by the combat developer as being most representative of anticipated operational situations and thus best suited for ASE requirements evaluation.

For each incident selected detailed threat laydowns were prepared using six-digit coordinates to locate each weapon in the TOE for those units in the scenario. User representatives plotted routes near or through the laydowns to depict the missions of the different aircraft. The routes were prepared with some knowledge of the weapon locations and capabilities and were planned so as to avoid encounters where possible. In actual combat situations, however, routes may not be followed precisely and intelligence on threat locations may not be timely or exact. The evaluation methodology accounts for these operational factors by allowing the aircraft to deviate from the planned routes and by introducing variations in pop-up points based on field trial experience. This results in a distribution of encounters for each of the different threat weapons and represents what encounters might occur over multiple missions rather than in one specific scenario.

The threats to Army aviation include small arms, antiaircraft artillery and missile systems, depending on the mission profile of the aircraft. Detailed operational and performance characteristics descriptions were prepared for each

specific threat weapon. Detection, acquisition, tracking, guidance, fly out and terminal effects capabilities were represented by analytical models of the threat systems using intelligence data as available and appropriate.

In addition to current threats, future weapon systems were also postulated based on logical technology growth patterns and other inputs from the intelligence community. These future threat laydowns were generated by substituting projected weapons for current systems. In this way the impact of threat advances (e.g., IR seeker technology) could be assessed without redefining the basic scenario.

CANDIDATE AIRCRAFT SURVIVABILITY EQUIPMENT (Block 3)

ASE considered as candidates in the requirements analysis include existing operational hardware, equipment in development and concepts for future development. By considering ASE in all stages of the life cycle, the results of the trade-off reflect a balance of short-range capability and long-range requirements. Since the cases evaluated in the analysis can be selected to represent both present and future operational situations, trade-off data will be available in the analysis to determine both present and future ASE systems requirements.

Descriptions and performance characteristics of candidate ASE are prepared by the hardware developer. Effectiveness parameters which are unique to each category and type of ASE are defined and quantified in terms compatible with the survivability assessment. Field data, test results and previous analyses, where available, serve as the basis for defining performance. Where this data is not available or when defining performance characteristics of concepts for future development, a parametric approach is often taken. By defining several candidate ASE which represent discrete designs over the range of technical feasibility, the relative merits of these parametric designs can be traded off. In this manner the relative penalty effectiveness and cost effectiveness of new concepts have been determined prior to committing significant development funds to demonstrate a concept. Where the trade-off data has shown that a new concept is neither penalty nor cost effective, even if the most optimistic performance parameters are assumed, it can be eliminated from consideration for development.

Even in cases where the effectiveness parameters of a particular ASE can be defined with some reliability, it is desirable to specify other characteristics

(weight, cost, MTBF, etc.) over a range to reflect any uncertainty which remains to be demonstrated by development. For example, although ASE has demonstrated feasibility in the advanced development stage, weight, cost and other characteristics of the production configuration are not known with certainty. By specifying a band for undemonstrated characteristics the risks still remaining in development are not obscured.

Table B.1 lists candidate ASE for the AH-1S attack helicopter included in the recent requirements analysis. The ASE have been grouped into four categories: optical countermeasures (OCM), electronic countermeasures or radar countermeasures (ECM), vulnerability reduction features (VR) and infrared countermeasures (IRCM).

The optical countermeasures candidates included the flat-plate canopy to reduce the probability of solar glints contributing to visual detection of the aircraft (this canopy is now incorporated in the production version of the AH-1S). Candidate optical contrast reduction (OCR) systems, optical warning location detection systems (OWL/D) and optical jamming (OJ) systems were parametrically represented by choosing several candidate systems that span the feasible performance parameters for each type of OCM. This resulted in the consideration of three OCRs, 12 OWL/Ds, and eight OJs. Based on the results of the requirements analysis, it has been possible to define those OCM system parameters which would give the most cost-effective and penalty-effective OCM systems.

ECM candidates included the Army's basic radar warning receiver, the APR-39, and a more sophisticated version of the APR-39, the APR-39(V2), which adds a digital processor. In addition, these radar warning receiver candidates were supplemented with a continuous wave (CW) warning capability to add two radar warning receiver candidates. Active ECM candidates included the XM-130 dispenser system that dispenses chaff decoys on command of the crew (based on radar warning receiver displays) and a group of nine radar jammers with characteristics representing a range of parameter variations over threat types addressed, field of regard, number of threats jammed simultaneously and type of jammer design (deceptive repeater, or mechanically modulated Luneberg lens reflector).

Vulnerability reduction features included design modifications to flight controls, fuel systems, engine lube, transmission lube, tail boom and main

OCM	ECM
Flat-plate canopy	Radar warning receiver
Optical contrast reduction	Basic
Optical warning location detection	Improved
Optical jammers	Chaff
	Supplemented
	Radar jammer

Vulnerability Reduction

- Flight controls
- Fuel systems
- Engine lubricants
- Transmission lubricants
- Tail boom
- Main rotor

Table B.1 AH-1S CANDIDATE ASE

rotor aircraft systems. The reduction of vulnerable area provided by these VR candidates against 7.62 millimeter, 12.7 millimeter, 14.5 millimeter API and 23 millimeter API and HEI ballistic projectiles was provided as input to the survivability assessment portion of the analysis.

Various <u>infrared countermeasures</u> were also included. (For details see the classified reference.)

A similar set of candidate ASE was tailored to each aircraft system and operating environment.

<u>SURVIVABILITY ASSESSMENT (Block 4)</u>

Survivability evaluation was performed with the aid of a mission survivability computer model developed specifically for the ASE program. The computer model is designed to accommodate the large number of possible ASE combinations (10,000 per aircraft), provide detailed representations of the ASE/threat system interactions and allow for operational considerations such as friendly and threat weapons employment tactics, NOE flight, maneuvers and environmental factors. The model is stochastic in nature, accepting probability distributions for the primary independent variables (engagement range, aspect, duration) and outputting an expected value of mission survival probability.

The mission survivability model requires the availability of a vast data array formed from the results of specialized feeder models. These include encounter and engagement statistics models, visual/optical detection models and threat simulation models for small arms, AAA, IR, RF and wire-guided missiles. The threat simulation models provide single-salvo probability of survival (PSS) data as a function of engagement range and aspect. The visual/optical detection model outputs detection probability as a function of time for given initial geometry conditions. The encounter and engagement models generate the expected number of each type of threat encountered on the mission and the distributions of these encounters as a function of range and aspect.

Each of these models must be exercised multiple times to account for the possible values of parameters that influence their results. Examples of these parameters are

- Hover or forward flight--IR signature, tracking errors, detection,

- Altitude—encounters (line of sight),
- Velocity—detection, tracking,
- Background—detection, IR acquisition, and
- ASE--PSSK with IRCM, ECM, OCM and VR equipments.

The result is an input data base requiring 3.35 million bytes of computer core.

Mission survivability is evaluated using the general approach shown in Figure B.3. For the theater and aircraft selected, baseline (no ASE) survival is computed by selecting a threat and flight mode and a set of range/aspect cells defining possible aircraft locations relative to the weapon position. Each cell in turn is chosen as the aircraft position and an exposure time loop is initiated. For each time selected the program computes the available firing time, considering detection time distributions, acquisition and fly-out times. The number of salvos (NS) for the available firing time is computed considering firing rates and reacquisition delays as appropriate. The applicable PSS for the threat/theater/aircraft combination is accessed and the incremental P_k for the cell is computed according to the relation $P_k = 1 - PSS^{NS}$. The P_k value is then weighted by the probability of occurrence of that particular exposure time and geometry condition. The process of selecting exposure times and engagement geometries is repeated and the incremental P_k values are weighted and summed until the possible times and geometries are exhausted. The result is the P_k expected if one threat of the type selected is encountered. The expected number of threats of this type encountered over the mission is obtained from the output of the encounter model and applied to the single-threat P_k to obtain a mission P_k for that threat. The next weapon is then selected and the process repeated until an overall baseline mission survivability is obtained.

Next, ASE are chosen for the aircraft and the cycle is repeated with the ASE effects applied to the threat operational cycle as indicated in the figure. Eleven different groupings of ASE must be considered using this methodology due to the interaction of their effects at different points in the operational cycle. These groups are

1. OCM
2. ECM
3. VR
4. IRCM
5. OCM + ECM
6. OCM + VR

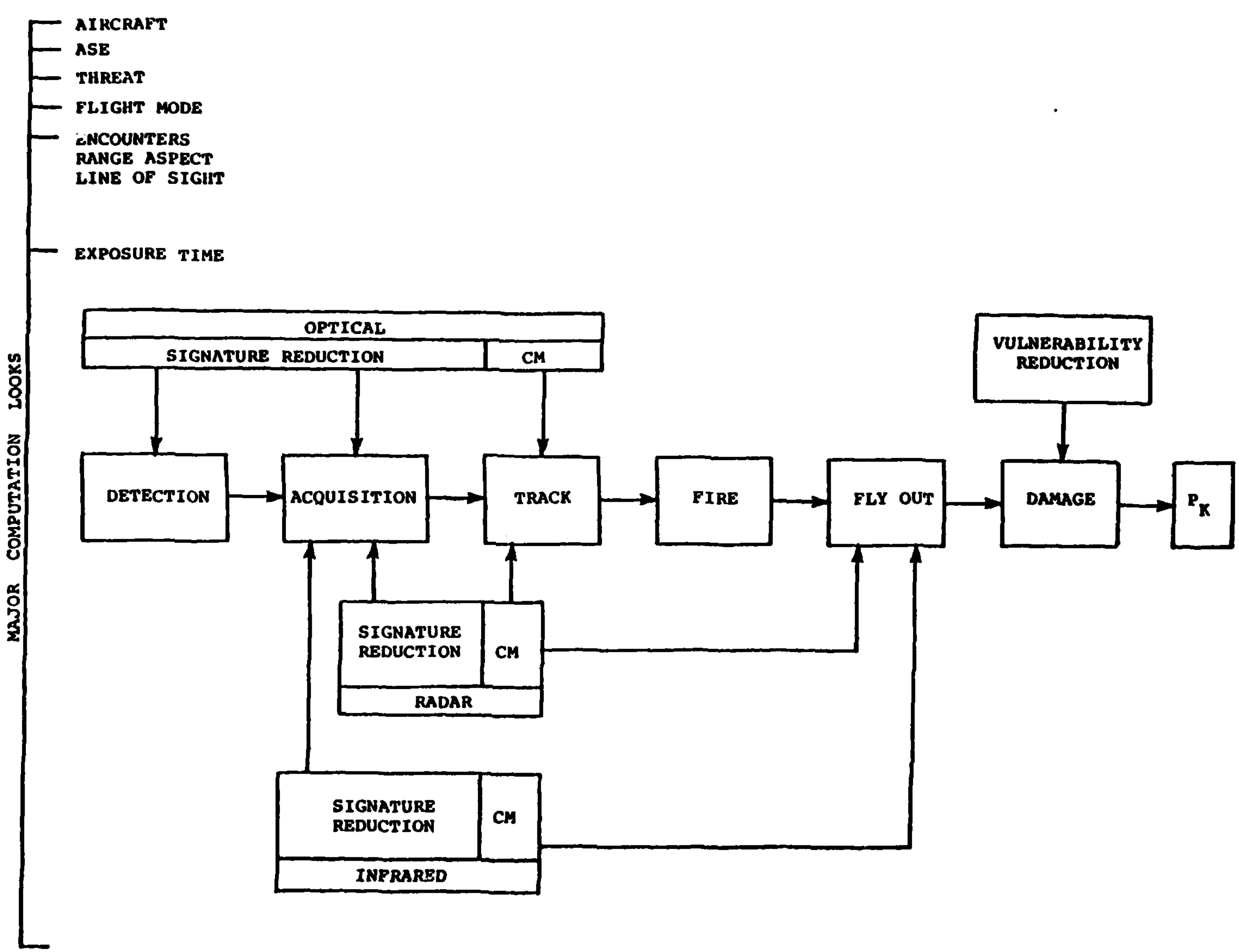

Figure B.3 MISSION SURVIVABILITY EVALUATION

7. ECM + VR
8. OCM + ECM + VR
9. OCM + IRCM
10. ECM + IRCM
11. OCM + ECM + IRCM

Mission survivabilities for the remaining combinations can be derived from the results of those above. The effectiveness of each ASE combination or suite is expressed in terms of a percent reduction in attribution relative to the baseline (no ASE) aircraft mission. This measure is defined as

$$\% \text{ Attribution Reduction} = \frac{P_{k_B} - P_k}{P_{k_B}} \times 100$$

where

P_{k_B} is the baseline mission P_k and

P_k is the mission P_k with ASE.

PENALTY ASSESSMENT (Block 4 continued)

A major area in establishing requirements for ASE is the assessment of penalties attributable to adding equipments to the aircraft. To do this it is first necessary to define a meaningful and quantifiable penalty measure that relates mission requirements and ASE characteristics that adversely affect the capability of meeting the requirements. The requirements are those minimum aircraft performance capabilities that must exist for the aircraft to accomplish its mission. Typical parameters are rate of climb, endurance and speed. Examples of ASE characteristics which degrade performance and contribute to penalty are power required, drag and weight. Associated with these is additional fuel needed to carry and operate the ASE. Payload penalty (lb) was the measure used to represent ASE effects on the aircraft performance capabilities during the mission. It may be thought of as a dead weight which, if carried by the aircraft, would produce a performance loss equivalent to that caused by the sum of the ASE characteristics that degrade performance.

The general approach taken to quantify ASE penalty was to first define for each mission a baseline aircraft configuration and sequence of events (e.g., takeoff, cruise, OGE hover) that represented aircraft actions during the

course of the mission. This phase was conducted with the active participation of user representatives. Aircraft performance computer models were used to estimate vehicle capabilities at each event and these were compared with a set of minimum requirements for the missions as established by the users. An iterative process was used to develop baseline missions that the aircraft could fly in the context of having an estimated capability at each event not less than the minimum requirement. Plots of velocity, gross weight, power rate of climb and fuel expenditure for the mission were generated (Figure B.4) as a means for this assessment. The baseline aircraft configurations, mission definitions and performance requirements were then reviewed by the user representatives as to their final suitability for ASE evaluation. The baseline missions so developed were used as the standard against which ASE penalty effects were assessed.

A parametric analysis was conducted for each aircraft/mission event sequence in which each ASE penalty parameter (e.g., drag) was varied over the range of values anticipated and a corresponding payload penalty calculated. The result was a set of penalty plots (Figure B.5) covering the range of values likely to occur for a penalty effective ASE suite. In the evaluation, the penalty contributions from each item in the candidate ASE suite were summed for each parameter to obtain penalty values for the suite. The plots were assessed with these values and multiple linear interpolations used to estimate the payload penalty for the suite. Payload penalty is essentially the sum of the ASE weight and the weight of additional fuel when performance minimums were not violated. This is illustrated by the shallow sloped portions of the curves in Figure B.5. When performance dropped below the minimums with the addition of ASE, some other payload would have had to have been off loaded at the start of the mission to accommodate the ASE. In this case, the mission payload penalty is the ASE weight plus the weight of additional fuel plus the weight of payload off loaded as shown by the steeper sections of the curves in Figure B.5.

<u>COST ASSESSMENT (Block 4 continued)</u>

The cost of each candidate ASE is estimated in terms of unit flyaway cost. Unit flyaway cost includes both recurring and nonrecurring production dollars for the major system equipment for each ASE (excludes initial spares and repair parts, support equipment, test equipment, etc.). Although this is a

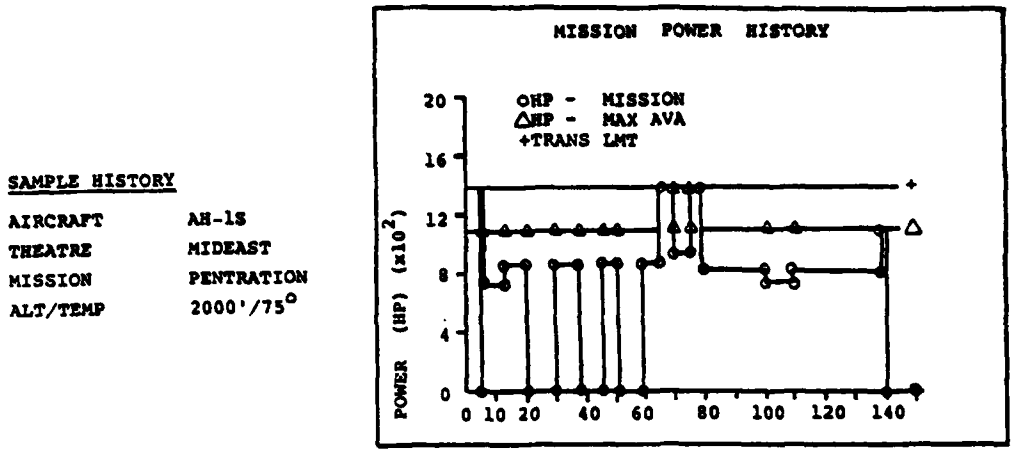

Figure B.4 PENALTY ASSESSMENT BASELINE MISSION REPRESENTATION

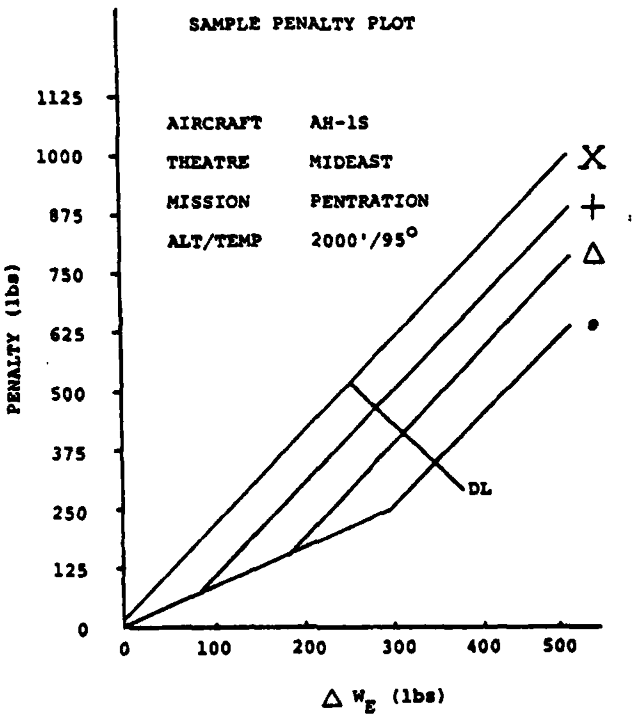

Figure B.5 PENALTY ASSESSMENT PARAMETRIC PENALTY ANALYSIS

limited cost definition, it is the dollar value that is usually associated with the unit cost of an item. Other cost elements which are expected to be unusually large for one ASE in relationship to another ASE can be considered separately in the assessment step. Because the computation of unit cost requires that a procurement quantity be established for each ASE, a tentative basis of issue is established for each ASE, considering its expected application across the aircraft fleet and theaters of operation.

TRADE-OFF (Block 5)

Block 5 in Figure B.1 represents the step where quantitative penalty- and cost-effective trade-offs are made for each possible ASE combination. This step reduces the number of candidate ASE combinations from thousands to usually less than 50 to 75 combinations. The remaining combinations consist of those which provide the most effectiveness for a given penalty or cost. Due to the large numbers of possible ASE combinations for any given case, this step must be accomplished by a specially designed computer program. This computer program, named CASETA (Candidate Aircraft Survivability Equipment Trade-off Analysis), accepts input from the survivability analysis, consisting of a baseline probability of survival for a given mission/theater/threat case for the aircraft without ASE and the new probability of survival for the aircraft equipped with each unique ASE combination. The survivability data is stated in terms of the total mission survivability and the individual probability of survival against each weapon in the threat array. In addition, for each ASE the unit flyaway cost, weight, the mean time between failures (MTBF), the percent reduction in horsepower, electrical power required, change in specific fuel consumption, and any download penalties associated with the ASE are input to the CASETA program. For each case analyzed, the results of the parametric penalty assessment are used by the CASETA program to compute the total payload penalty to the aircraft/mission for each ASE combination. The CASETA computer program considers every possible ASE combination in turn, chooses the most penalty-effective and cost-effective combinations and plots each of these remaining ASE combinations in two plots as shown in Figure B.6. Those ASE combinations that are penalty effective are plotted as a circle, those that are cost effective are plotted as a triangle and any combination that is both penalty and cost effective is plotted as a +. The

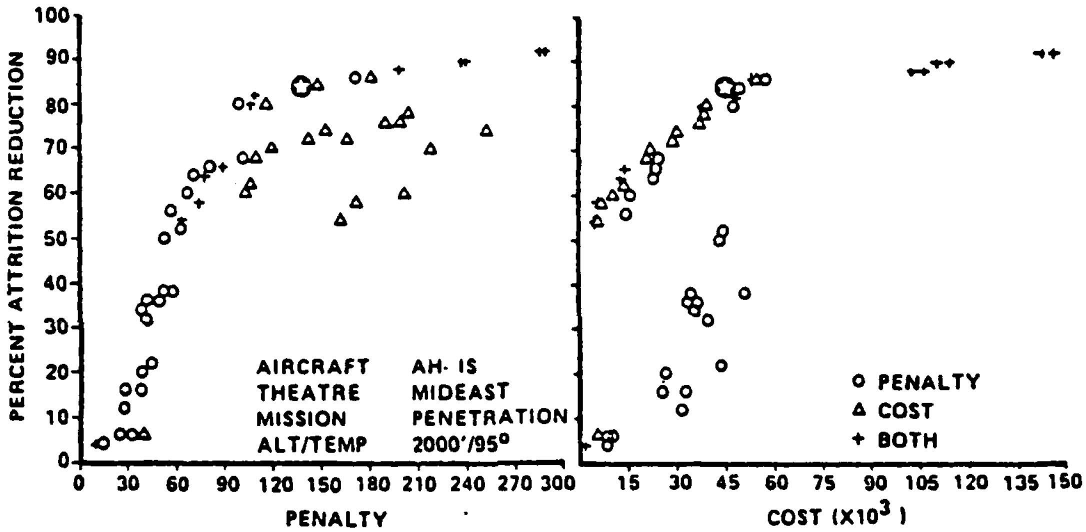

Figure B.6 PENALTY AND COST EFFECTIVE ASE SUITES

combination of ASE associated with each point in the plot is identified by the CASETA program in the margin of the plot (not shown in Figure B.6). The graphical form of the presentation of penalty- and cost-effective ASE combinations in Figure B.6 allows the analyst to visualize a point of diminishing returns (or breakpoint), that is, the point at which adding more ASE and, therefore, increasing penalty and cost no longer provides a significant increase in reduction of attrition. Also, it is easy to see which combinations of ASE are both penalty and cost effective and where, in fact, large groups of penalty-effective combinations of ASE are not cost effective and, conversely, where large groups of cost-effective ASE are not penalty effective. The ideal combinations of ASE fall right at the breakpoint of both the penalty- and cost-effective curves. In Figure B.6 one such combination has been indicated on both plots by a star. Each analysis run for a given aircraft will provide a different set of penalty- and cost-effective combinations of ASE and possibly different breakpoint ASE systems for that case. The next step in the methodology, the assessment, must sort out these different results from the trade-off step, as well as weigh the importance of other parameters not quantitatively traded off by the CASETA computer program.

THE ASSESSMENT (Block 6)

Figure B.7 diagrams the functions performed in the assessment. The objective of this step is to *synthesize quantitative trade-off* data with other quantitatively and qualitatively evaluated factors to arrive at a recommendation for the ASE system for each aircraft in the analysis.

The trade-off data (plots and other tables, etc.) from the trade-off CASETA computer program are reviewed together with other results of the survivability penalty and cost assessments to establish preliminary constraints on the parameters of the ASE configurations. For example, the penalty constraints for weight, reduction in engine power, drag, etc., are to be established based on the mission performance evaluation in penalty assessment and the penalty-effectiveness curves from the trade-off step. Penalty constraints are set either by the maximum effectiveness that can be achieved over the largest number of mission/theater/temperature altitude/threat variations before the point of diminishing return is reached on the penalty-effectiveness curves or by mission constraints, whichever is more severe. Overall mission effectiveness is the final

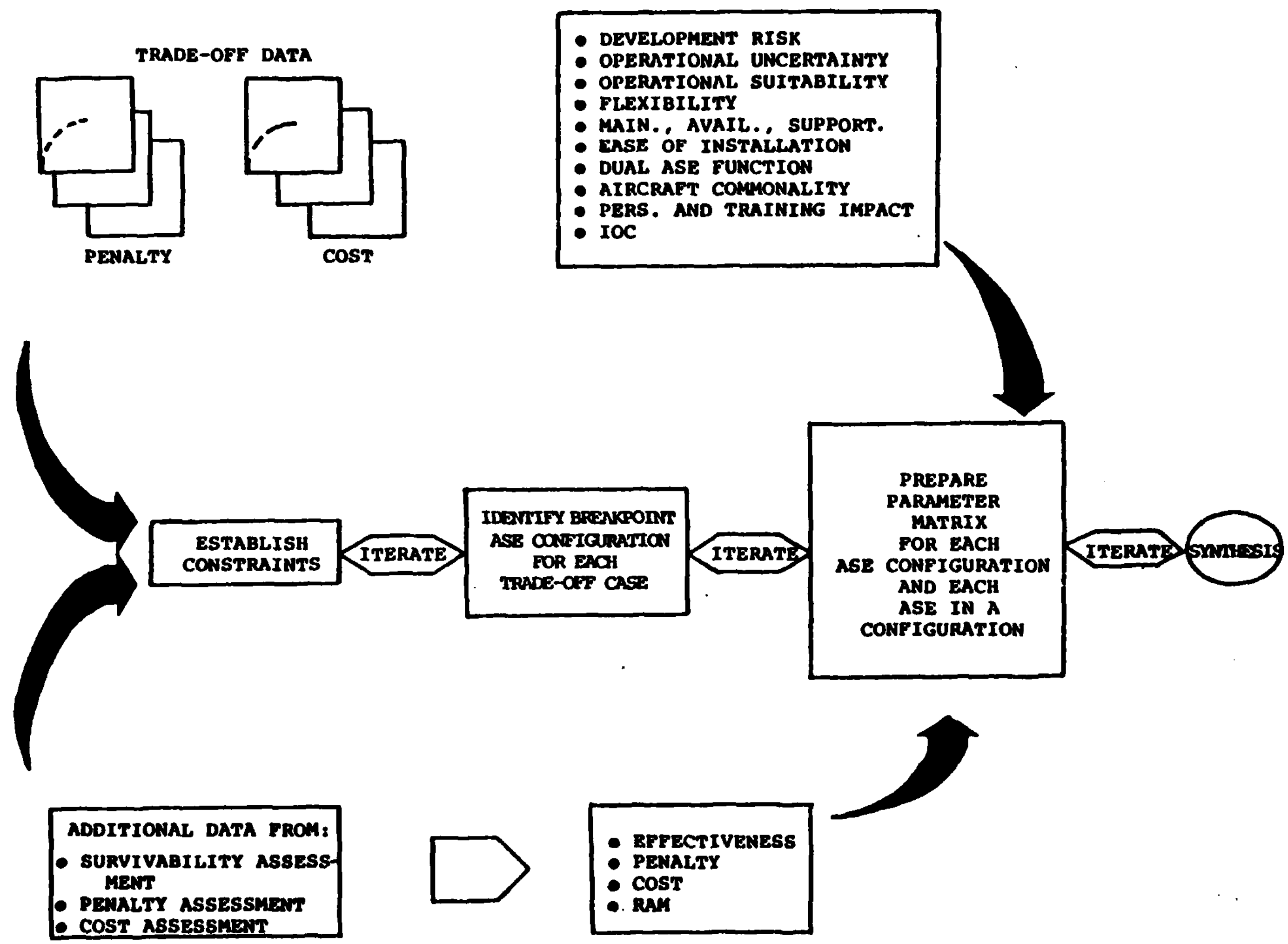

Figure B.7 ASSESSMENT

arbitrator in setting penalty constraints. From the data available, the positive aspects of increased survivability are weighed against the negative effects of penalty. Next, the breakpoint ASE combinations are identified for each trade-off case by choosing the most effective ASE combination on the trade-off curves that falls within the constraints and/or lies on the knee of the curve.

For each ASE configuration identified, a trade-off parameter matrix is prepared stating the characteristics of each ASE combination. The parameter matrix normally includes a breakout of the characteristics of each individual ASE in the configuration. In addition to the specification of quantitative parameters (such as effectiveness, penalty, cost and RAM parameters), the parameter matrix includes the qualitative factors listed below:

- Development risk,
- Operational suitability,
- Operational uncertainty,
- Flexibility,
- Maintainability, availability, supportability,
- Ease of aircraft installation,
- Dual functioning ASE,
- Aircraft commonality,
- Personnel and training impact, and
- IOC date.

The definitions for these factors are

Development Risk: The assessed risk of developing ASE in accordance with requirements for performance, penalty, reliability, etc.

Operational Suitability: The relative ease in air-crew management of all functions associated with the required countermeasure to include reaction time, interpretation, activation, etc.

Operational Uncertainty: The uncertainty as to whether when fielded and employed a particular ASE will, in fact, function as expected

	against the actual threat that exists at that time (e.g., the threat may have been improved).
Flexibility:	The degree to which an ASE can deal with new or changing threats.
Maintainability, Availability,	The assessed ease of maintenance and Supportability: support; the percent of time the equipment is fully functional and on line for use.
Ease of Aircraft Installation:	The ease of both the initial installation of provisions ("A" Kit) and subsequent installations (if appropriate) of the major ASE components ("B" Kit).
Dual Functioning ASE:	The extent to which a particular ASE functions against several categories of threats (e.g., a dispenser system can dispense chaff to defeat radar-guided weapons and flares to defeat IR missiles).
Aircraft Commonality:	The degree to which a particular ASE can be proliferated among different aircraft (e.g., an RWR used on the AH-1, UH-1, OH-58, CH-47, etc.).
Personnel and Training Impact:	The extent to which additional training is required and/or special personnel are required to maintain or operate the ASE.
IOC Date:	Date when operational system, including equipment, training and logistic support will be available in the field.

Table B.2 lists assessment factor ratings for selected types of ASE. Each of these ratings is backed with detailed justification as part of the assessment step.

ASSESSMENT FACTOR	IR SUPPRESSOR	LOW REFLECTANCE PAINT	MISSILE DETECTOR	FLARE DISPENSER	IR JAMMER	OPTICAL PAINT SCHEME	OPTICAL WARN. RCVR.	OPTICAL CONTRAST RED.	OPTICAL JAMMER	LASER DETECTOR	RADAR WARNING RCVR.	RADAR JAMMER	LUNEBURG RADAR JAMMER	CHAFF DISPENSER	VULNERABILITY REDUCTION	POSSIBLE RATINGS
DEVELOPMENT RISK	M	L	M	ML	ML	MH	MH	MH	H	M	L	ML	H	ML	ML	H,MH,M,ML,L
OPERATIONAL SUITABILITY	G	G	G	S-P[1]	G	G	G-F	G	G	G	G-P[2]	G	G	F	G	G,F,P
OPERATIONAL UNCER.	L	L	ML	ML	M	M	M	M	M	ML	ML	M	H	ML	L	H,MH,M,ML,L
FLEXIBILITY	E	N/A	G	G	F	N/A	F	G	F	G	G	F	P	E	N/A	E,G,F,P
MAIN.,AVAIL., SUPPORT.	G	G	G	F	F-G	G	F	F	F	G	G	G	F	F	L	G,F,P
EASE OF INSTALLATION	G	G	G	G	F	G	F	F	F	G	F	F-G	F	G	M	G,F,P
DUAL ASE FUNCTION	NO	YES	NO	YES	NO	NO	NO	NO	NO	NO	YES[3]	NO	NO	YES	NO	YES,NO
AIRCRAFT COMMONALITY	NO	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	NO	YES,NO
PERS. AND TRAINING IMPACT	L	L	L	L	L	L	M	L	M	M	M	L	L	M	L	H,M,L
IOC	76	76	81	79	77-80	77	82	>82	>82	81	77	80	>82	79	78-79	CALENDAR YEAR

KEY: H = HIGH
MH = MODERATELY HIGH
M = MODERATE
ML = MODERATELY LOW
L = LOW
E = EXCELLENT
G = GOOD
F = FAIR
P = POOR

1. GOOD WHEN MDS OPERATIONAL, POOR W/O MDS
2. GOOD WITH DIGITAL, FAIR WITH ANALOG
3. RWR CRT'S CAN BE MADE TO DISPLAY LWR + OWR WARNING DATA

Table B.2 ASE ASSESSMENT FACTOR RATINGS

ASE SYSTEMS (Block 7)

The data in Table B.2 are then used to develop a recommended ASE system for a specific aircraft. The system is defined first in terms of the generic requirement and then for each generic requirement in terms of the specific equipment. This system is divided into two groups of equipment: (1) required as standard and (2) backup, alternatives, or ASE required for special missions. The required-as-standard ASE system consists of those ASE's that provide a nucleus of equipment necessary for aircraft survival for most missions, theaters and threat conditions in the next five to ten years. In addition, the ASE in the required-as-standard system have been demonstrated as fully feasible and ready for deployment, production or full-scale development. Backup or alternative ASE systems, which are equally as cost and penalty effective as their required-as-standard counterparts, have been identified for full-scale development where a significant uncertainty in threat capability exists. Improved ASE capabilities have also been identified for full-scale development for those special missions for which their required-as-standard counterparts do not provide full capability for protection.

SUMMARY

The systematic determination of ASE system requirements and program goals when realized by the successful development and deployment of ASE systems will provide a materiel capability to survive on the modern battlefield. Together with professionalism, training, tactics and other means of air defense suppression, ASE developed to meet these requirements goals will give Army aviation combat forces the staying power necessary to accomplish their missions in the presence of sophisticated enemy air defense threats.

TERMINOLOGY

This section briefly summarizes the meaning of abbreviations and terminology appearing throughout this paper.

AAA	
API	Armor piercing incendiary ammunition
ASE	Aircraft survivability equipments
CASETA	Candidate ASE Trade-off Analysis
contour	Terrain flight at constant speed and varying altitude
CW	Continuous wave

ECM	Electronic countermeasures (e.g., radar jammers, warning receivers, chaff)
FEBA	Forward edge of the battle area
HEI	High explosive incendiary ammunition
IOC	Initial operational capability
IRCM	Infrared countermeasures (e.g., IR jammers, suppressors, flares)
low level	Terrain flight at constant speed and altitude
MTBF	Mean time between failures (hr)
NOE	Nap of the earth, terrain flight with varying speed and altitude
OCM	Optical countermeasures
OCR	Optical contrast reduction
OGE	
OJ	Optical jammer, an active countermeasure against optically tracking threat systems
OWL/D	Optical Warning Location Detection (System), provides warning of optically tracking threats
P_k	Probability of kill
P_kB	Baseline Mission Probability of kill
PSS	Single shot or single salvo probability of survival
PSSK	
RAM	Reliability,availablility,maintainability.
RF	Radio frequency, refers to a missile guidance mode
ROC	Required operational capability
RWR	
SCORES	Scenario Oriented Recurring Evaluation System

TOE	Table of organization and equipment
VR	Vulnerability reduction, aircraft design features reducing P_k due to impacting projectiles and fragments

APPENDIX C
SOURCES OF ASSISTANCE

Within the materiel acquisition process in general and the integration of countermeasures and counter-countermeasures in particular, the basic functions of the Army commands are

- DARCOM and its subordinate commands study, evaluate and develop the technology and methodology for providing CCM in support of developmental systems.
- TRADOC, with its functional centers, schools and combat development activities, develops the tactics and doctrine for CCM in a CM environment. This command represents the interests of the users of the systems being designed, developed and deployed.
- INSCOM is the threat manager for the Army. It develops the threat statements in support of major and designated nonmajor systems and provides guidance and assistance in the development of threat statements for other nonmajor systems.
- OTEA is the manager of user testing for the Army. It conducts operational and force development tests for major and designated nonmajor systems and provides guidance and assistance in the testing of other nonmajor systems.

This appendix identifies those laboratories, centers, agencies and commands which can provide assistance in the CM/CCM process. The appendix is provided in two parts:

- Part I--Areas of Proponency. Approximately 200 areas of interest to the users of this manual have been identified and correlated with their proponent elements.
- Part II--Laboratories, Centers, Agencies and Commands--A brief narrative describing the responsibilities and functions of each of the Laboratories, Centers, Agencies and Commands is provided. Mailing addresses and telephone numbers (AUTOVON and commercial) are included.

The user of this Appendix should proceed as follows:

- Identify the area of interest where assistance is required. Using Part I, identify the proponent agency or agencies.
- Locate the proponent element in Part II, and confirm that the agency's area of responsibility includes the desired subject.
- Request assistance from the agency, using the points of contact provided.
- If unable to identify an agency providing the assistance required, contact the DARCOM or TRADOC CM/CCM office, as appropriate.

PART I
AREAS OF PROPONENCY

Acoustic intelligence	EWL
Acoustic radiation	AMMRC
Acoustic radiation absorption	AMMRC
Acoustic technology	CSTAL
ADP measurement/diagnostic equipment	CENTACS
ADP systems	CORADCOM
Aeronautical propulsion	AVRADCOM
Air assault doctrine	USAIS, USAAVNC
Air defense doctrine	USAADS
Air defense tactical data systems	MICOM
Airmobile systems	ARTL
Air mobility support equipment	AVRADCOM
Air navigation systems	AVRADA
Air traffic regulation systems	AVRADA
Airborne communications integration	AVRADA
Aircraft structures	AVRADCOM
Aircraft survivability equipment	PM ASE; AVRADCOM
Aircraft vulnerability analysis	PM ASE; AVRADCOM
Anthropometric data	HEL
Antiarmor doctrine	USACAC, USAARMS
Antiballistic missile systems	MIA
Antiradiation missile CM	HDL
Antitank guided missile systems	MIA, MICOM
Armaments technology	ARRADCOM
Armored combat vehicle technology	TARADCOM
Artillery doctrine	USAFAS
Aviation doctrine	USAAVNC, USAARMS, USATSCH
Aviation electronic systems	AVRADA
Aviation landing systems	AVRADA

Aviation risk assessment	ARTL
Avionics technology	AVRADA
Ballistic missiles	MICOM
Ballistics	ARRADCOM
Ballistics technology	BRL
Ballistics vulnerability	BRL
Barrier systems	MERADCOM
Battlefield interdiciton	USAFAS
Battlefield systems architecture	CSEI
Battlefield systems integration	CSEI
Behavioral reactions	HEL
Biological docxrine	USAOCCS
Biological hardening	AMSAA
Biomedical factors	HEL
Body armor	NARADCOM
Camouflage	MERADCOM
CCM EO techniques	NVEOL; OTD; EWL
Chemical combat support	CSL
Chemical doctrine	USAOCCS
Chemical hardening	AMSAA
Chemical munitions	CSL
Combat support systems	CSEI
Combat surveillance	CSTAL
Command fuzes	HDL
Communication doctrine	USASIGS
Communication electronic systems	EWL; CORADCOM; ERADCOM; CERCOM
Communication equipments	CENCOMS
Communication processes	CENCOMS
Communication security (COMSEC)	CENCOMS
Communication systems	CORADCOM
Computer sciences	CENTACS
Counter-countermeasures (CCM)	EWL; TRASANA; DARCOM CM/CCM Off; TRADOC CM/CCM Off.

Counterfire doctrine	USAFAS
Counterintelligence	EWL
Countermeasures (CM)/CCM documentation	DARCOM CM/CCM Off; TRADOC CM/CCM Off
CM/CCM management	USACAC; DARCOM CM/CCM Off; TRADOC CM/CCM Off
CM/CCM studies/evaluation	DAROM CM/CCM Off; TRADOC CM/CCM Off
Countermine	MERADCOM
Data transmission	CSTAL; CORADCOM
Deception	EWL
Defensive chemical/biological devices	CSL
Development testing (DT)	TECOM
Direction finding	EWL
Electronic counermeasures (ECM) effectiveness	ERADCOM
ECM susceptibility/vulnerability	EWL
Electric power generation/distribution	MERADCOM
Electromagnetic radiation	BRL; AMMRC
Electromagnetic radiation absorption	AMMRC
Electronic CCM (ECCM)	HDL; EWL
Electronic dependent weapons	EWL; MICOM; ARRADCOM
Electronic materiel acquisition	ERADCOM
Electronic parts/devices/assemblies	ERADCOM; ET&DL
Electronic target acquisition/identification	ERADCOM
Electronic technology	ET&DL
Electronic warfare doctrine	USAICS; USAIS (FT DEVENS)
Electronic warfare (EW) systems	ERADCOM; EWL; SWL
Electro-optical (EO)CM/CCM	OTD; EWL
Energetic materials	ARRADCOM
Engineer doctrine	USAES

Explosives	BRL
Explosives research	BRL; FC&SC WSL
Facsimile/data communications	CENCOMS
Far infrared	NVEOL
Field artillery doctrine and tactics	USAFAS
Field artillery tactical data systems	CORADCOM
Field support equipment	NARADCOM
Fighting vehicle armament systems	TARADCOM
Fire control equipment	MICOM; ARRADCOM; FC&SC WSL
Fire coordination equipment	MICOM
Fire support coordination	USAFAS
Flame/incendiary	CSL
Flight rockets	MICOM
Fluidics	HDL
Fragmentation/penetration	BRL
Free flight rockets	MICOM
Frequency spectrum management	CSEI
Fuel fires	BRL
Fuels/lubricants	MERADCOM
Fusing	ARRADCOM
Fuzing technology	HDL
General intelligence	ITAC
Ground laser designators	MICOM
Ground support missile equipment	MICOM
Guidance and control	MICOM; HDL; BRL
Guided missiles	MICOM
Guided weapons	OTD
High power/energy lasers	MICOM
Human factors engineering/research	HEL
Human performance	HEL
IFFN	CSTAL
Image intensification	NVEOL
Incendiary devices	BRL
Infantry doctrine	USAIS

Infrared protection	PM ASE
Instrumentation and simulation	HDL
Intelligence doctrine	USAICS
Intercept	EWL; SWL
Jamming	EWL; SWL
Laser designators	MICOM
Laser hardening	AMMRC
Laser radiation	BRL
Laser systems	MICOM
Low-speed aeronautics	AVRADCOM
Lubricants	MERADCOM
Manpower characteristics	HEL
Materials	AMMRC
Materials testing	AMMRC
Missile and munitions doctrine	USAMMCS
Missile fire control equipment	MICOM
Missile fire coordination equipment	MICOM
Missile guidance methods	BRL; HDL; MICOM
Missile launching equipment	MICOM
Multicommand data systems	CSC
Multiservice communications systems	CORADCOM
Munitions effectiveness	AMSAA
Night operations doctrine	USACAC
Night vision technology	NVEOL
Nonnuclear hardening	AMSAA
Nuclear doctrine	USACAC
Nuclear radiation detection	CSTAL
Nuclear weapons effects	HDL
Obscurants	PM Smoke; USAOCS
Operational testing (OT)	OTEA
Operations and intelligence tactical data systems	CORADCOM
Operations security (OPSEC) support	ITAC
Optically guided missile protection	PM ASE

Penetration	BRL
Photography	CSTAL
Physical/biological sciences	NARADCOM
Physical security sensors	MERADCOM
Pilot night vision systems	AVRADCOM
Pollution abatement	CSL
Propagation of electromagnetic radiation	BRL
Propagation of shock and blast	BRL
Proximity fuzes	HDL
Qualitative estimates analysis	FSTC
Quick reaction development	EWL
Radar protection	PM ASE
Radar systems	CSTAL
Radiation absorption	AMMRC
Radiological survey	CSTAL
Radio systems	CENCOMS
Reliability, availability, and maintainability (RAM) methodology	AMSAA
Remote sensing	CSTAL
Rockets	MICOM
Scientific analysis of capabilities	FSTC
Scientific and technical intelligence	FSTC
Self-propelled vehicles	TARADCOM
Shock and blast propagation	BRL
Short-range ballistic systems	MIA
Signal analysis	EWL
Signal intelligence (SIGINT)	EWL; SWL
Signal security systems	SWL; CORADCOM
Signature analysis	HDL; BRL
Smoke	PM Smoke; CSL; USAOCS
Software design, development and support	CSC
Solid mechanics	AMMRC
Space programs	ASPO
Structural materials	AMMRC
Surface-to-air systems	MIA

Survivability AMSAA	
Systems analytic support	AMSAA; TRASANA
Tactical automatic data processing (ADP) systems	AMSAA; TRASANA
Tactical communications systems	CORADCOM
Tactical computer-based systems	CENTACS
Tactical command, control, communications, and intelligence systems C^3I	CSEI
Tactical data systems	CSC; CORADCOM
Tactical sensors	MERADCOM
Tactical vehicle research and development	TARADCOM
Tank armament systems	ARRADCOM
Tank science and technology	TARADCOM
Target acquisition	CSTAL
Target acquisition designator systems	AVRADCOM
Target detection	HDL; BRL
Target identification and recognition	BRL
Target missiles	MICOM
Target servicing—indirect fire	USAFAS
Technical analysis capabilities	FSTC
Telegraphic systems	CENCOMS
Telephone systems	CENCOMS
Terminal guidance/homing	HDL; MICOM
Test evaluation	OTEA; AMSAA; TECOM
Thermal radiation	AMMRC
Thermal radiation absorption	AMMRC
Threat analysis support	TRASANA; ITAC
Threat management	ITAC
Threat methodology	ITAC
Threat preparation	TMs; FIOs
Threat production	ITAC
Threat projections	ITAC
Threat validation	ITAC
Time fuzes	HDL
Visionics	NVEOL
Vulnerability EWL	

PART II

LABORATORIES, CENTERS, AGENCIES AND COMMANDS

AMMRC

U.S. ARMY MATERIALS AND MECHANICS RESEARCH CENTER (DARCOM)

- Manages the DARCOM R&D structural materials and mechanics program as lead laboratory for materials, solid mechanics and materials testing technology. Conducts technology programs in materials and mechanics used in Army materiel. Responsible for materials and materials testing efforts in laser hardening and electromagnetic, thermal and acoustic radiation absorption.

Director, U.S. Army Materials and Mechanics Research Center	AUTOVON: 955-3275/3350
ATTN: DRXMR-C	Commercial:
Watertown, MA 02172	(617) 923-3275/3350

AMSAA

U.S. ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY (DARCOM)

- AMSAA is designated as the DARCOM lead laboratory for survivability and is responsible for nonnuclear hardening and chemical and biological hardening. Under the auspices of the Theater Nuclear Force Program, AMSAA has the responsibility to provide data relative to the vulnerability/survivability of Army forces. AMSAA also provides independent evaluation, systems analysis and cost effectiveness study support to DARCOM.

Director, U.S. Army Materiel Systems Analysis Activity	AUTOVON: 283-2997
ATTN: DRXSY-TF	Commercial:
Aberdeen Proving Ground, MD 21005	(301) 278-2997

ARRADCOM

U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND (DARCOM)

- Conducts or manages research, development, life-cycle engineering, initial acquisition and acquisition through transition to Armament Materiel Readiness Command of artillery, infantry and air defense gun weapons, fire control systems (except missile), rocket and missile warheads, demolition munitions, chemical munitions and related items. (See DARCOM-R 10-70 for details.)

Commander, U.S. Army Armament	AUTOVON:
Research and Development Command	880-4644/5671
ATTN: DRDAR-SER	Commercial:
Dover, NJ 07801	(201) 328-4644/5671

ARTL

U.S. ARMY AVIATION RESEARCH AND TECHNOLOGY LABORATORIES (DARCOM)

- Manages and executes research and development of Army airmobile systems through demonstration of technology. Provides technical support to project/product managers and system developers as required. Provides independent technical risk assessment to AVRADCOM and other agencies as required.

Director, U.S. Army Aviation	AUTOVON:
Research and Technology Laboratories	462-5907
Ames Research Center	Commercial:
Moffett Field, CA 94305	(415) 965-5584

BRL

U.S. ARMY BALLISTIC RESEARCH LABORATORY (DARCOM)

- Performs the functions of lead laboratory for ballistics and for vulnerability/vulnerability reduction. Establishes and maintains a weapons oriented basic research program in physics, chemistry, mathematics and engineering. Conducts and directs an effort towards the solution of specific military problems related to ballistics and vulnerability with the purpose of developing and evaluating the feasibility and practicability of proposed solutions and determining their parameters. BRL is responsible for terminal effects of conventional and special weapons-explosive research, warhead mechanics, fragmentation, penetration, shock and blast propagation, fuel fires (incendiary and combustion), laser radiation, target signatures, propagation of electromagnetic radiation and detection recognition, and identification of targets, as well as methods of missile guidance.

Director, Ballistic	AUTOVON:
Research Laboratory	283-4509
USA ARRADCOM	
ATTN: DRDAR-BLB	Commercial:
Aberdeen Proving Ground, MD 21005	(301) 278-4509

CACDA

U.S. ARMY COMBINED ARMS COMBAT DEVELOPMENT ACTIVITY (TRADOC)

- Conducts combat development activities in combined arms functional areas. Develops joint and combined doctrinal concepts and organizations. (See TRADOC Reg 10-41 for details.)

Commander,	AUTOVON:
U.S. Army Combined Arms	552-4992
Combat Development Activity	Commercial:
ATTN: ATZLCA-CO	(913) 684-4992
Ft. Leavenworth, KS 66027	

CENCOMS

U.S. ARMY COMMUNICATIONS SYSTEMS CENTER (DARCOM)

- Responsible for that portion of the CORADCOM mission pertaining to research and development related to communications equipments and systems. This responsibility encompasses R&D in the fields of radio, telephone, telegraphic, facsimile and data communications; switching; communications security; and communications processes.

Director, U.S. Army Communications	AUTOVON:
Systems Center	995-4449
ATTN: DRDCO-COM	Commercial:
Ft. Monmouth, NJ 07703	(201) 544-4449

CENTACS

U.S. ARMY TACTICAL COMPUTER SYSTEMS CENTER (DARCOM)

- Serves as the focal point and source within DARCOM for overall engineering support of tactical computer-based systems. Conducts and directs technology-base research and development programs in tactical ADP systems and computer sciences and in test, measurement and diagnostic equipment.

Director, U.S. Army Tactical	AUTOVON:
Computer Systems Center	995-2312
ATTN: DRDCO-TCS	Commercial:
Ft. Monmouth, NJ 07703	(201) 544-2312

CORADCOM

U.S. ARMY COMMUNICATIONS RESEARCH AND DEVELOPMENT COMMAND (DARCOM)

- Conducts and manages research, design, development, life-cycle engineering, training development, initial acquisition, first production, production assurance, test and integrated logistics support functions for communications, ADP, COMSEC and related items. (See DARCOM-R 10-74 for details.)

Commander, U.S. Army Communications	AUTOVON:
Research and Development Command	995-4262
ATTN: DRDCO-PPA	Commercial:
Ft. Monmouth, NJ 07703	(201) 554-4262

CSC

U.S. ARMY COMPUTER SYSTEMS COMMAND (DARCOM)

- Plans, directs and controls all aspects of multicommand data system design, development, test, installation, and software maintenance and update and provides technical support to commands using multicommand systems. CSC also performs design, development, test and support of software for tactical data systems.

Commander, U.S. Army	AUTOVON:
Computer Systems Command	354-1732
Ft. Belvoir, VA 22060	Commercial:
	(703) 664-1732

CSEI

U.S. ARMY SYSTEMS ENGINEERING AND INTEGRATION CENTER (DARCOM)

- Manages the Battlefield Systems Integration responsibilities of CORADCOM. Directs the systems architecture, system engineering and technology development, interoperability, integration and evaluation of the Army automated tactical command, control, communications and intelligence systems and combat support systems. Manages Army use of frequency spectrum. Controls the commonality, compatibility, interoperability, standardization, affordability and effectiveness of all tactical C^3I systems.

Director, U.S. Army Systems	AUTOVON:
Engineering and Integration Center	992-4159
ATTN: DRDCO-SE	Commercial:
Ft. Monmouth, NJ 07703	(201) 532-4159

CSL

U.S. ARMY CHEMICAL SYSTEMS LABORATORY (DARCOM)

- Conducts research and development on Army chemical munitions, chemical combat support material such as smoke, flames, incendiaries, and riot control and chemical/biological defensive items. Serves as the DARCOM lead laboratory for pollution abatement technology.

Commander/Director, U.S. Army	
Chemical Systems Laboratory	AUTOVON:
USA ARRADCOM	584-4363
ATTN: DRDAR-CLD	
Aberdeen Proving Ground, MD 21010	(301) 671-4363

CSTAL

COMBAT SURVEILLANCE AND TARGET ACQUISITION LABORATORY (DARCOM)

- Performs research and development to include initial production related to equipment for combat surveillance, target acquisition, IFFN and radiological survey. Maintains a technology base in radar, remote sensing, acoustics, data transmission, IFFN, nuclear radiation detection and measurement and photography.

Director, U.S. Army Combat Surveillance and Target Acquisition Laboratory	AUTOVON:
ATTN: DELCS-D	996-5556/5218
Ft. Monmouth, NJ 07703	Commercial:
	(201) 544-5556/5218

DARCOM CM/CCM Office

DARCOM COUNTERMEASURES/COUNTER-COUNTERMEASURES (CM/CCM) OFFICE

- Provides the focal point within DARCOM for CCM. Assists in drafting LOAs, ROCs, MENS and DPs to determine that CM/CCM are considered. Tasked to assist in developing a CCM group at each appropriate R&D laboratory. Assists the developer as required in CM/CCM studies/evaluations prepared by the developer.

Commander, U.S. Army Electronic Research and Development Command	AUTOVON:
ATTN: DRDEL-CCM	290-3160
2800 Powder Mill Road	Commercial:
Adelphi, MD 20783	(202) 394-3160

ERADCOM

U.S. ARMY ELECTRONICS RESEARCH AND DEVELOPMENT COMMAND (DARCOM)

- Responsible for electronic material acquisition through first production and initial fielding to include research, development, engineering and product improvement of materiel to enhance the Army's capability to (a) locate, identify and designate enemy targets; (b) survive the effects of enemy counteraction, including nuclear weapons effects, electronic warfare and related actions; (c) render the enemy's forces ineffective with ECM; (d) collect intelligence on enemy plans and actions; (e) obtain atmospheric information necessary for tactical operations and fire control; (f) provide electronic devices, subassemblies or components; and (g) contribute to the technology base in areas relevant to the ERADCOM mission. (See DARCOM-R 10-75 for details.)

Commander, U.S. Army Electronic Research and Development Command ATTN: DRDEL-E 2800 Powder Mill Road Adelphi, MD 20783	AUTOVON: 290-3179 Commercial: (202) 394-3179

ET& DL

ELECTRONICS TECHNOLOGY AND DEVICES LABORATORY (DARCOM)

- Plans and executes an R&D program in electronic technology to include the development of electronic parts, devices, assemblies and the related disciplines and techniques for Army equipment.

Director, U.S. Army Electronics Technology and Devices Laboratory ATTN: DELET-D Ft. Monmouth, NJ 07703	AUTOVON: 995-2541 Commercial: (201) 544-2541

EWL

U.S. ARMY ELECTRONIC WARFARE LABORATORY (DARCOM)

- Performs the R&D essential to electronic warfare and selected areas of intelligence. This encompasses applied R&D including quick-reaction development and support in the areas of intercept, direction finding, signal analysis, jamming, deception, signal intelligence, agent equipment, security, counterintelligence, vulnerability and CCM. Provides timely electronic countermeasures susceptibility/vulnerability assessments of communications electronics systems and electronics-dependent weapons and mobility systems that are subject to hostile EW/SIGINT.

Director, U.S. Army Electronic	AUTOVON:
Warfare Laboratory 995-4538	
ATTN: DELEW-V	Commercial:
Ft. Monmouth, NJ 07703	(201) 544-4538

FC&SCWSL

FIRE CONTROL AND SMALL CHLIBER WEAPON SYSTEMS LABORATORY

- Conducts or manages research, development, life-cycle engineering and associated technical base activities in connection with assigned fire control and small caliber (40 mm and below) weapon systems and ancillary items. Manages and executes the total Army fire control mission for all weapon system applications except missiles.

Commander	AUTOVON:
USA ARRADCOM	880-2734/6495
ATTN: DRDAR-SC	Commercial:
Dover, New Jersey 07801	(201) 328-2734/6495

FSTC

U.S. ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER (DARCOM)

- Responsible for developing, maintaining and disseminating continuous scientific and technical intelligence analysis of foreign ground forces capabilities and equipment. FSTC also establishes qualitative estimates of future capabilities as guided by susceptibility/vulnerability assessments.

Commander, U.S. Army Foreign	AUTOVON:
Science and Technology Center	274-5171
220 Seventh Street, N.E.	Commercial:
Charlottesville, VA 22901	(804) 296-5171

HDL

HARRY DIAMOND LABORATORIES (DARCOM)

- Conducts R&D for influence, time, and command fuzing, target detection and signature analysis, electronic CCM, nuclear weapons effects, fluidics, instrumentation and simulation. HDL is the DARCOM lead laboratory for fluidics technology and nuclear weapons effects technology and provides technical direction of Army antiradiation missile CM.

Commander,	AUTOVON:
Harry Diamond Laboratories	290-2002
ATTN: DELHD-D	Commercial:
2800 Powder Mill Road	(202) 394-2002
Adelphi, MD 20783	

HEL

U.S. ARMY HUMAN ENGINEERING LABORATORY (DARCOM)

- Conducts human factors research, development and engineering for DARCOM materiel. Develops new human factors and engineering methodology. Integrates all manpower characteristics into the Army material development program. Serves as lead laboratory for DARCOM's human factors engineering program.

Director, U.S. Army Human	AUTOVON:
Engineering Laboratory	283-3883
Aberdeen Proving Ground, MD 21005	Commercial:
	(301) 278-3883

ITAC

INTELLIGENCE AND THREAT ANALYSIS CENTER (INSCOM)

- Performs threat analysis and validation to support Army materiel and combat development activities. Provides advice and assistance to other Army commands with respect to intelligence-related matters.

Commander	AUTOVON:
U.S. Army Intelligence and	222-1795
Security Command	Commercial:
ATTN: IAX	(202) 692-1795
4000 Arlington Blvd.	
Arlington, VA 22212	

LCWSL

LARGE CALIBER WEAPON SYSTEMS LABORATORY (DARCOM)

- Manages the life cycle of assigned large caliber (above 40 mm) weapon systems and ancillary items to produce technical data packages validated by early production. Plans and conducts the technology-base, life-cycle engineering and system integration actions required to assure the prompt fielding and continuing availability of assigned items.

Commander	AUTOVON:
USA ARRADCOM	880-2544/2549
ATTN: DRDAR-LC	Commercial:
Dover, NJ 07801 (201) 328-2544/2549	

MERADCOM

U.S. ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT COMMAND (DARCOM)

- Conducts basic and applied research, design, production engineering, standardization, design testing and test evaluation on assigned items of equipment: countermine, camouflage, barrier systems, tactical sensors, fuels, lubricants, fuels handling equipment, marine and railway transportation equipment, electric power generation and distribution equipment, tactical environmental control equipment, supply distribution and materiel handling equipment, water and waste management equipment, physical security sensors and engineer topographic systems. MERADCOM is designated the DARCOM lead laboratory for countermine and camouflage technology.

Commander, U.S. Army Mobility Equipment	AUTOVON:
Research and Development Command	354-2654
ATTN: DRDME-RT	
Ft. Belvoir, VA 22060 (703) 664-2654	

MIA

U.S. ARMY MISSILE INTELLIGENCE AGENCY (DARCOM)

- Subordinate to MICOM and responsive to DIA, MIA is charged to develop, maintain and disseminate a continuous scientific and technical intelligence analysis of capabilities and equipments employed in foreign antiballistic, surface-to-air, short-range ballistic and antitank guided missile systems. MIA also is responsible for establishing qualitative estimates of future capabilities in the areas described.

Commander, U.S. Army Missile Command	AUTOVON:
ATTN: DRDMI-Y	746-5536
Redstone Arsenal, AL 35809	Commercial:
	(205) 876-5536

MICOM

U.S. ARMY MISSILE COMMAND (DARCOM)

- Performs DARCOM lead laboratory activities pertaining to high power/energy laser science and technology and guidance and control/terminal homing technology. Performs R&D and exercises integrated management on assigned materiel: free-flight rockets, guided missiles, ballistic missiles, target missiles, high power/energy laser systems, special purpose and multisystems test equipment, missile launching and ground support equipment, missile fire coordination equipment and laser designators. Determines the ECM and ECCM capabilities/requirements and techniques to increase Army missile system effectiveness and performs R&D to provide, improve and exceed ECCM capabilities to meet these requirements.

Commander, U.S. Army Missile Command	AUTOVON:
ATTN: DRSMI-RGS	746-7705
Redstone Arsenal, AL 35809	Commercial:
	(205) 876-7705

NARADCOM

U.S. ARMY NATICK RESEARCH AND DEVELOPMENT COMMAND (DARCOM)

- Performs R&D in the physical and biological sciences and engineering to meet military requirements in the assigned commodity areas: food, textiles, clothing, body armor, organic materials, insect and fungus controls, food-service equipment, field-support equipment and air-delivery equipment. (See DARCOM-R 10-77 for details.)

Commander, U.S. Army Natick	AUTOVON:
Research and Development Command	955-2407
ATTN: DRXNM-ZT	Commercial:
Natick, MA 01760	(617) 653-2407

NVEOL

NIGHT VISION AND ELECTRO-OPTICS LABORATORIES (DARCOM)

- Responsible for providing the Army with a night vision capability with the goal of carrying out night operations with daylight efficiency. Maintains technology base consisting of the disciplines of image intensification, far infrared, radiation sources and visionics. NVL is also responsible for R&D of CCM EO techniques necessary to harden night vision systems to current and future enemy threats.

Director, U.S. Army Night Vision	AUTOVON:
and Electro-Optics Laboratories	354-5102
ATTN: DELNV-D	Commercial:
Ft. Belvior, VA 22060 (703) 644-5102	

OMEW

OFFICE OF MISSILE ELECTRONIC WARFARE (DARCOM)

- Subordinate to EWL, OMEW determines the vulnerability of U.S. Army missile systems to EW and recommends inprovements; also develops and maintains a continuous ECM vulnerability analysis of foreign missile systems.

Commander and Director	AUTOVON:
Office of Missile Electronic Warfare	258-2256
U.S. Army Electronic Warfare Laboratory	Commercial:
ATTN: DELEW-M-D	(505) 678-2256
White Sands Missile Range, NM 88002	

OTD

OFFICE OF THE TEST DIRECTOR FOR JOINT SERVICES ELECTRO-OPTICAL GUIDED WEAPON COUNTERMEASURES TEST PROGRAM (DOD)

- Performs Tri-Service level basic research on electro-optical CM/CCM; utilized to compliment the the EO capabilities of the Army. The OTD is responsible for conducting tests to determine the limitation of U.S. EO guided weapons (EO-GW) in a countermeasure environment. Assists OTEA/TECOM in the planning for and the conduct of OT/DT and follow-on tests of EO-GW systems concerning CM vulnerability. The OTD also provides information to EO-GW developers for effective CCM action.

Commander,	AUTOVON:
U.S. Army Test and Evaluation Command	283-5323/4492
ATTN: DRSTE-TO-F	Commercial:
Aberdeen Proving Ground, MD 21005	(301) 278-5323/4492

OTEA

U.S. ARMY OPERATIONAL TEST AND EVALUATION AGENCY (CSA)

- Ensures that operational tests are effectively planned, conducted and evaluated with emphasis on adequacy, quality and credibility; provides policy and guidance for all OT; develops and promulgates test and evaluation methodology; also provides representation on and assistance to Special Task Force, Special Study Group and Test Integration Working Group. OTEA supports the materiel acquisition and force development process by exercising responsibility for all OT and by managing Force Development Testing and Experimentation and joint user testing for the Army.

Commander,
U.S. Army Operational Test and
Evaluation Agency
ATTN: CSTE-TDD
5600 Columbia Pike
Falls Church, VA 22041

AUTOVON:
289-2305
Commercial:
(703) 756-2305

PM ASE

PROJECT MANAGER, AIRCRAFT SURVIVABILITY EQUIPMENT (DARCOM)

- Responsible under charter for aircraft survivability equipment consisting of protection against infrared, radar and optically guided and/or directed weapons systems. Program objective is to provide self-protection for the current Army aircraft fleet, contingency protection equipment; vulnerability analysis and development of survivability techniques and equipment, and a viable technical data base within DARCOM to interface with future aircraft development programs.

Commander, U.S. Army Aviation Research
and Development Command
ATTN: PM ASE
St. Louis, MO 63166 (314) 268-3961

AUTOVON:
698-3961
Commercial:

PM Smoke

PROJECT MANAGER, SMOKE/OBSCURANTS (DARCOM)

- Plans, directs and controls all materiel development and readiness activities for the Army smoke/obscurants program. The PM Smoke is responsible for maintaining cognizance of and ensuring that necessary research and exploratory development are conducted to provide a technology base for smoke/obscurant agents and dissemination devices in response to established requirements, a smoke/obscurant munitions effectiveness and counter-effectiveness information data bank, and solutions for specific smoke problems.

Project Manager, AUTOVON:
Smoke/Obscurants 283-2804/4249
Building 324 Commercial:
Aberdeen Proving Ground, MD 21005 (301) 278-2804/4249

SWL

U.S. ARMY SIGNALS WARFARE LABORATORY (DARCOM)

- Responsible for the research, development, acquisition and integration of equipment required to support the Army's mission pertaining to signal intelligence, electronic warfare and signal security.

Director, U.S. Army Signals AUTOVON:
Warfare Laboratory 249-6600
ATTN: DELSW-SS
Vint Hill Farms Station (703) 347-6600
Warrenton, VA 22186

TARADCOM

U.S. ARMY TANK-AUTOMOTIVE RESEARCH AND DEVELOPMENT COMMAND (DARCOM)

- Plans and conducts research, exploratory and advanced development for combat and tactical vehicle systems and subsystems, to include chassis for self-propelled vehicles and related items. TARADCOM is the lead laboratory for tank science and technology. (See DARCOM-R 10-82 for details.)

Commander, U.S. Army Tank-Automotive	AUTOVON:
Research and Development Command	273-1142
ATTN: DRSTA-CL	Commercial:
Warren, MI 48090 (313) 573-1142	

TECOM

U.S. ARMY TEST AND EVALUATION COMMAND (DARCOM)

- Plans, conducts and reports the government portion of development testing (DT). Evaluates and assesses the results of DT. Develops capabilities and methodologies for testing CCM effectiveness when not currently available within the DOD. Effects coordination to provide for the efficient use of DARCOM test capabilities through combined development tests. Evaluates communications-electronics systems compatibility/vulnerability.

Commander,	AUTOVON:
U.S. Army Test and Evaluation Command	283-2477
ATTN: DRSTE-CT-C	Commercial:
Aberdeen Proving Ground, MD 21005	(301) 278-2477

TRADOC CM/CCM OFFICE

TRADOC COUNTERMEASURES/COUNTER-COUNTERMEASURES (CM/CCM) OFFICE

- Serves as the TRADOC point of contact for all CM/CCM and related matters. Reviews all materiel acquisition requirements documents to ensure compliance with all CM/CCM requirements. Coordinates CM/CCM actions with the DARCOM CM/CCM office and INSCOM (ITAC).

Commander, U.S. Army Combined Arms	AUTOVON:
Combat Development Activity	552-5595
ATTN: ATZLCA-COM-G	Commercial:
Ft. Leavenworth, KS 66027	(913) 684-5595

TRASANA

TRADOC SYSTEMS ANALYSIS ACTIVITY

- Serves as the TRADOC supporting analytic activity for studies and analyses in support of the combat and materiel development processes. Performs analyses in support of the Theater Nuclear Forces Survivability and Countermeasures Assurance Programs. Provides advice and assistance on CM/CCM capabilities and analysis on specific CM/CCM issues and monitors operational tests for designated systems to assure tests address critical CM/CCM. TRASANA also provides threat and analysis support for the CM/CCM assurance program.

Commander,	AUTOVON:
TRADOC Systems Analysis Activity	258-3604
ATTN: ATAA-TDB	Commercial
White Sands Missile Range, NM 88002	(915) 678-3604

USAADS

U.S. ARMY AIR DEFENSE SCHOOL (TRADOC)

- Conducts combat development activities, including development of operational concepts, battlefield strategy and tactics and materiel requirements statements, for assigned items and areas. (See TRADOC Reg 10-41 for details.)

Commandant,
U.S. Army Air Defense School
ATTN: ATSA-CD
Ft. Bliss, TX 79916

AUTOVON:
978-7690/1392

Commercial:
(915) 568-7690/1392

USAARMS

U.S. ARMY ARMOR SCHOOL (TRADOC)

- Conducts combat development activities, including development of operational concepts, battlefield strategy and tactics and materiel requirements statements, for assigned items and areas. (See TRADOC Reg 10-41 for details.)

Commandant,
U.S. Army Armor School
ATTN: ATSB-CD
Ft. Knox, KY 40121

AUTOVON:

Commercial:
(502) 624-2251/1555

USAAVNC

U.S. ARMY AVIATION CENTER (TRADOC)

- Conducts combat development activities, including development of operational concepts, battlefield strategy and tactics and materiel requirements statements, for assigned items and areas. (See TRADOC Reg 10-41 for details.)

Commander,
U.S. Army Aviation Center
ATTN: ATZQ-CD
Ft. Rucker, AL 36362

AUTOVON:
558-4612/4613
Commercial:
(205) 225-4612/4613

USACAC

U.S. ARMY COMBINED ARMS CENTER (TRADOC)

- Coordinates and integrates the products of all three TRADOC integrating centers, and of the CAC-associated schools. Integrates and coordinates materiel requirements in combined arms functional areas. Develops joint and combined doctrinal concepts and organizations. (See TRADOC Reg 10-41 for details.)

Commander, U.S. Army Combined Arms Center
ATTN: ATZLCA-DL
Ft. Leavenworth, KS 66027

AUTOVON:
552-4887
Commercial:
(913) 684-4887

USAES

U.S. ARMY ENGINEER SCHOOL (TRADOC)

- Conducts combat development activities, including development of operational concepts, battlefield strategy and tactics and materiel requirements statements, for assigned items and areas. (See TRADOC Reg 10-41 for details.)

Commandant, U.S. Army Engineer School	AUTOVON:
ATTN: ATSE-CD	354-3512
Ft. Belvoir, VA 22060 Commercial:	
	(703) 664-3512

USAFAS

U.S. ARMY FIELD ARTILLERY SCHOOL (TRADOC)

- Conducts combat development activities, including development of operational concepts, battlefield strategy and tactics and materiel requirements statements, for assigned items and areas. (See TRADOC Reg 10-41 for details.)

Commandant, U.S. Army Field Artillery School	AUTOVON:
ATTN: ATSF-CD-AD	639-5707/4491
Ft. Sill, OK 73503	Commercial:
	(405) 351-5707/4491

USAICS

U.S. ARMY INTELLIGENCE CENTER AND SCHOOL (TRADOC)

- Conducts combat development activities, including development of operational concepts, battlefield strategy and tactics and materiel requirements statements, for assigned items and areas. (See TRADOC Reg 10-41 for details.)

Commandant,
U.S. Army Intelligence Center and School
ATTN: ATSI-CD
Ft. Huachuca, AZ 85613

AUTOVON:
879-3841/5381
Commercial:
(602) 538-3841/5381

USAIS

U.S. ARMY INFANTRY SCHOOL (TRADOC)

- Conducts combat development activities, including development of operational concepts, battlefield strategy and tactics and materiel requirements statements, for assigned items and areas. (See TRADOC Reg 10-41 for details.)

Commandant,
U.S. Army Infantry School
ATTN: ATSH-CD
Ft. Benning, GA 31905

AUTOVON:
835-1915/1016
Commercial:
(404) 545-1915/1016

USAMMCS

U.S. ARMY MISSILE AND MUNITIONS CENTER AND SCHOOL (TRADOC)

- Conducts combat development activities, including development of operational concepts, battlefield strategy and tactics and materiel requirements statements, for assigned items and areas. (See TRADOC Reg 10-41 for details.)

Commandant, U.S. Army Missile and	
Munitions Center and School	AUTOVON:
ATTN: ATSK-CD	764-2764/4550
Redstone Arsenal, AL 35809	Commercial:
	(205) 876-2762/4550

USAOCCS

U.S. ARMY ORDNANCE AND CHEMICAL CENTER AND SCHOOL (TRADOC)

- Conducts combat development activities, including development of operational concepts, battlefield strategy and tactics and materiel requirements statements, for assigned items and areas. (See TRADOC Reg 10-41 for details.)

Commander, U.S. Army Ordnance and	
Chemical Center and School	AUTOVON:
ATTN: ATSL-CLC	584-4323/3713
Aberdeen Proving Ground, MD 21005	Commercial:
	(301) 671-4323/3713

USASIGS

U.S. ARMY SIGNAL SCHOOL (TRADOC)

- Conducts combat development activities, including development of operational concepts, battlefield strategy and tactics and materiel requirements statements, for assigned items and areas. (See TRADOC Reg 10-41 for details.)

Commandant, Hq U.S. Army Signal School	AUTOVON:
ATTN: ATSN-CD	
Ft. Gordon, GA 30905	Commercial:
	(404) 791-7571/6223

USATSCH

U.S. ARMY TRANSPORTATION SCHOOL

- Conducts combat development activities, including development of operational concepts, battlefield strategy and tactics, and materiel requirements statements, for assigned items and areas. (See TRADOC Reg 10-41 for details.)

Commandant,	
USATSCH	927-3986
Attn: ATSP-CD	Commercial:
Ft. Eustis VA 23604	(804) 878-3986

APPENDIX D
REFERENCES

Department of Defense Directives

C-4600.3	Electronic Counter-countermeasures (ECCM) Policy (U)
5000.1	Major System Acquisitions
5000.2	Major System Acquisition Process
5000.3	Test and Evaluation

Department of the Army Regulations

AR 5-5	The Army Study System
AR 10-4	U.S. Army Operational Test and Evaluation Agency, Organization and Functions
AR 10-5	Department of the Army, Organization and Functions
AR 10-11	United States Army Materiel Development and Readiness Command, Organization and Functions
AR 10-41	U.S. Army Training and Doctrine Command, Organization and Functions
(C)AR 10-53	U.S. Army Intelligence and Security Command, Organization and Functions (U)
AR 15-14	Systems Acquisition Review Council Procedures
AR 70-1	Army Research, Development and Acquisition
AR 70-10	Test and Evaluation during Development and Acquisition of Materiel
AR 70-15	Product Improvement of Materiel
AR 70-17	System/Program/Project/Product Management
AR 70-27	Outline Development Plan/Development Plan/Army Program Memorandum/Defense Program Memorandum/Decision Coordinating Paper
AR 70-61	Type Classification of Army Materiel
AR 71-3	User Testing
AR 71-9	Materiel Objectives and Requirements
(C)AR 105-2	Electronic Counter-Countermeasures (ECCM) - Electronic Warfare Susceptibility and Vulnerability (U)
AR 310-25	Dictionary of United States Army Terms
AR 381-11	Threat Analysis

(C)AR 530-1	Operations Security (OPSEC) (U)
AR 702-3	Army Materiel Reliability, Availability and Maintainability (RAM)
AR 702-9	Production Testing of Army Materiel
AR 702-10	Post-Production Testing of Army Materiel
AR 1000-1	Basic Policies for Systems Acquisition

Department of the Army Pamphlets

DA Pam 11-25	Life Cycle System Management Model for Army Systems
DA Pam 70-21	The Coordinated Test Program (CTP)
DA Pam 381-14	Threat Analysis and Materiel Acquisition

Miscellaneous DA Publications

OACSI Ltr, Guidance to Agencies Preparing Threat Documentation in Support of Nonmajor Systems, 6 October 1978

ODCSOPS, Mission Element Need Statements (MENS)

ODCSOPS, (C) Science and Technology Objectives Guide, FY79 (STOG-79) (U)

DARCOM Regulations

DARCOM-R	10-1	Organization Control, Concepts, Policies, Responsibilities and Documentation
DARCOM-R	10-2	Headquarters, DARCOM, Organization, Mission, and Functions Manual
DARCOM-R	10-5	U.S. Army Foreign Science and Technology Center, Organization and Functions
DARCOM-R	10-6	Mission and Major Functions of the U.S. Army Materiel Systems Analysis Activity
DARCOM-R	10-24	Mission and Major Functions of the U.S. Army Test and Evaluation Command
DARCOM-R	10-25	Mission and Major Functions of the USA Materials and Mechanics Research Center
AMC Reg	10-36	Mission and Major Functions of the Harry Diamond Laboratories
DARCOM-R	10-70	Mission and Major Functions of the U.S. Army Armament Research and Development Command

DARCOM-R	10-74	Mission and Major Functions of the U.S. Army Communications Research and Development Command
DARCOM-R	10-75	Mission and Major Functions of the U.S. Army Electronics Research and Development Command
DARCOM-R	10-77	Mission and Major Functions of the U.S. Army Natick Research and Development Command
DARCOM-R	10-80	Mission and Major Functions of the U.S. Army Missile Research and Development Command
DARCOM-R	10-82	Mission and Major Functions of the U.S. Army Tank-Automotive Research and Development Command
DARCOM-R	11-1	Systems Analysis
DARCOM-R	11-16	Program/Project/Product Management
DARCOM-R	11-27	Life Cycle Management of DARCOM Materiel
DARCOM-R	70-4	DARCOM Policy on Countermeasures/Counter-Countermeasures
AMC Reg	70-5	Materiel Acquisition Decision Process Reviews
AMC Reg	70-26	Electronics Warfare Research and Development for Army Missiles
AMC Reg	70-53	Non-nuclear Vulnerability and Vulnerability Reduction
AMC Reg	70-58	Camouflage Research and Development for Army Materiel
DARCOM-R	381-1	Foreign Intelligence Operations
(O) DARCOM-R	381-2	Quick Reaction Capability for Overseas Acquisition/Exploitation of Foreign Materiel
DARCOM-R	381-4	Foreign Materiel Program
DARCOM-R	702-9	System Assessment Program

DARCOM Memorandum

DARCOM-M	70-1	Headquarters DARCOM, Management of the Product Improvement Program

DARCOM Supplements to AR

Suppl 1 to AR 530-1	Operations Security
Suppl 1 to AR 530-2	Operations and Signal Security

Miscellaneous DARCOM Publications

Materiel Acquisition Management Guide

Overview, DARCOM Research and Development Commands and Laboratories

Guide to Camouflage for DARCOM Equipment Developers

Foreign Intelligence Office Handbook

(S) U.S. Army SEMI Handbook (U)

INSCOM Publication

Threat Analysis Procedures Handbook (Draft)

Joint DARCOM/TRADOC Publications

AMC-TRADOC Materiel Acquisition Handbook

OPM ASE/USA Avn Ctr/CALSPAN Corp., (C) Establishing Aircraft Survivability Equipment Requirements for Army Aircraft (U)

TRADOC Regulations

TRADOC Reg	10-41	Mission Assignments
TRADOC Reg	11-8	Cost and Operational Effectiveness Analysis in the Materiel Acquisition Process
TRADOC Reg	71-3	Acceptance and Assignment of New Combat Development Tasks
TRADOC Reg	71-5	Scenario Oriented Recurring Evaluation System (SCORES)
TRADOC Reg	71-9	User Testing and Evaluation
TRODOC Reg	381-1	Threat Development

TRADOC Pamphlets

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TRADOC PAM	71-12	Combat Developments Staff Officers Handbook

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Total System Management (Draft)

Report of Threat Managers (TM) Conference, 11 September 1978

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Countermeasures/Counter-Countermeasures (CM/CCM) Considerations for Army Materiel Systems, 29 October 1976

Threat Support for Combat Developments, CACDA TM Orientation, October 1978

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LOI: Mission Area Analysis (MAA), 25 September 1979

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